THE IRON TRADE REVIEW

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In 1915 Rogers, Brown & Company sold 22.14% of all the Merchant Pig Iron Produced in the United States

(This is based on statistics of The American Iron and Steel Institute.)

Their total sales during 1915 were 3,281,523 tons of Pig Iron, Coke, etc.

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It means repeat orders

Repeat orders mean Satisfied Customers

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PITTSBURGH, PA.

THE IRON TRADE REVIEW

Vol. LVIII Cleveland, April 27, 1916 No. 17

Increased Demand From Abroad

Mills Being Offered Immense Tonnages for Export—Large Tonnages of Pig Iron Purchased—More Price Advances

HEAVY buying of pig iron is being carried on in a very quiet way, and it is evident that recent transactions, including the purchase of about 50,000 tons of basic by the Jones & Laughlin Steel Co. and a very large tonnage of foundry iron by a radiator company, represent a general and very active buying movement. Unusual conditions existing are illustrated by the fact that the Bethlehem Steel Co., which is a large producer of pig iron and usually a seller, has been compelled to come into the market and buy 6,000 tons of basic in order to complete delivery of iron sold to an eastern Pennsylvania steelmaker. The Bethlehem company, in order to fulfill its contract, accepted a loss of several dollars per ton. The Reading Iron Co., another producer, has been obliged to come into the market for 10,000 tons of prompt forge iron. There is a strong demand for low phosphorus pig iron for export next year, including 20,000 tons for Canada and the far east. The inquiry for bessemer for export to France sent out by J. P. Morgan & Co. calls for from 40,000 to 80,000 tons for the remainder of this year. The only week spot in the pig iron market is in the south, which is still feeling the effects of warrant iron.

St. Louis steelmakers have placed orders for 50,000 tons of basic for this year's delivery with the leading Alabama producer.

Munition Material

Buyers of large rounds suitable for the manufacture of shells are making some extraordinary propositions to mills. An Ohio producer has been offered $75 per ton for the first option up to about 15,000 tons of any steel not specified by other purchasers under contracts.

Plates

Although some orders for plates are still being entered at 2.75c, Pittsburgh, for delivery at the convenience of the mill, ship builders are now buying steel for all of next year on specific work for which they are paying large producers 2.90c for plates and 2.50c for shapes. About 20,000 tons for new boats have been placed during the past week, including three vessels for Norwegian companies. The new ship yard to be built at Chester, Pa., by the Sun Co., an important oil concern, will be the largest in the country with the exception of the New York Ship Building Co.'s plant and will require 60,000 tons of steel annually. This is regarded as one indication of how increased output of iron and steel after the war may be consumed.

Bolts, Nuts and Rivets

Bolts and nuts have again been advanced from 10 to 15 per cent, and rivets $10 per ton. Rivets are now selling at the highest price ever recorded. Standard steel pipe and line pipe have been advanced from $4 to $10 per ton, and wrought iron pipe from $4 to $8. Some welded pipe makers are quoting higher than published prices.

Iron Ore

The first lake iron ore of the season was delivered at Buffalo last Saturday by the WILLIS L. KING and loading at upper lake ports is being carried on rapidly. The movement of boats has been greatly interfered with by heavy ice and fogs. A Cleveland firm has made a sale of 35,000 tons of low phosphorus ore, for which the demand is greater than the tonnage available, owing to the heavy inquiry for low phosphorus pig iron for export.

Foreign Buying

Despite reports of decreased foreign buying, leading steelmakers are now being offered more steel business for export than at any time since war was declared. New domestic business is also heavier than ever. The Duluth plant of the Corporation is sold up for the remainder of this year. In oil country pipe, there is a decided shortage.

Railroad Buying

To avoid paying the advance in price of steel rails, effective May 1, there has been heavy buying during the past week, and total sales recently are estimated at 800,000 tons. The first sale at the higher price was one of 9,000 tons booked by the Corporation for a southern road for delivery in July and August of next year.

THE OPEN HEARTH

Remarkable Record of Irregular Orders

THE WHOLE attitude of the navy department and of the navy committees of both branches of congress seems to indicate a determination to have their way as to a national armor plant regardless of cost or reason, or of the injury done to private establishments, or the more than probable irretrievable error to which it commits the nation. The latter especially is inexplicable at a time when all sections and all parties should be bending their efforts towards strengthening the national resources for defense.

The latest figures available on the subject are those in the *Naval Year Book,* published by the government, for the year ending June 30, 1915. The first contract for armor with a domestic plant was with the Bethlehem Steel Co., in 1887. Including 1914, awards to the Bethlehem company amounted to 92,613 tons. The *Year Book* shows tonnages in each year, but frequently also shows several different prices which, of course, apply to the different classes of armor, such as side, turret, barbette, etc., but does not specify the tonnage at each price. We, therefore, have taken the average of each year. The average by years then works out at $462 per ton, but extending the tonnage year by year gives an average for the whole period of $439 per ton. Figures just given out by the Bethlehem company, bringing the record to date, show a total of 95,072 tons at an average price of $432.62 per ton.

In 1890, the Carnegie company entered the field and has been awarded 66,474 tons. The average price by years was $450; the average by tons, $516. The latter figure arises from the fact that the first two awards, 1890 and 1893, were for fairly large tonnages and at the highest prices paid for armor in this country, Bethlehem securing none in 1890, and the 1893 award being for considerably higher tonnage than Bethlehem.

In 1903, the third company, the Midvale Steel Co., became a competitor. It has been awarded a total of 48,562 tons. The average by years is $421 and by tons $433. The total armor awarded to the three companies, then, amounts to 210,108 tons, and the average price, determined as previously explained, is $464 per ton.

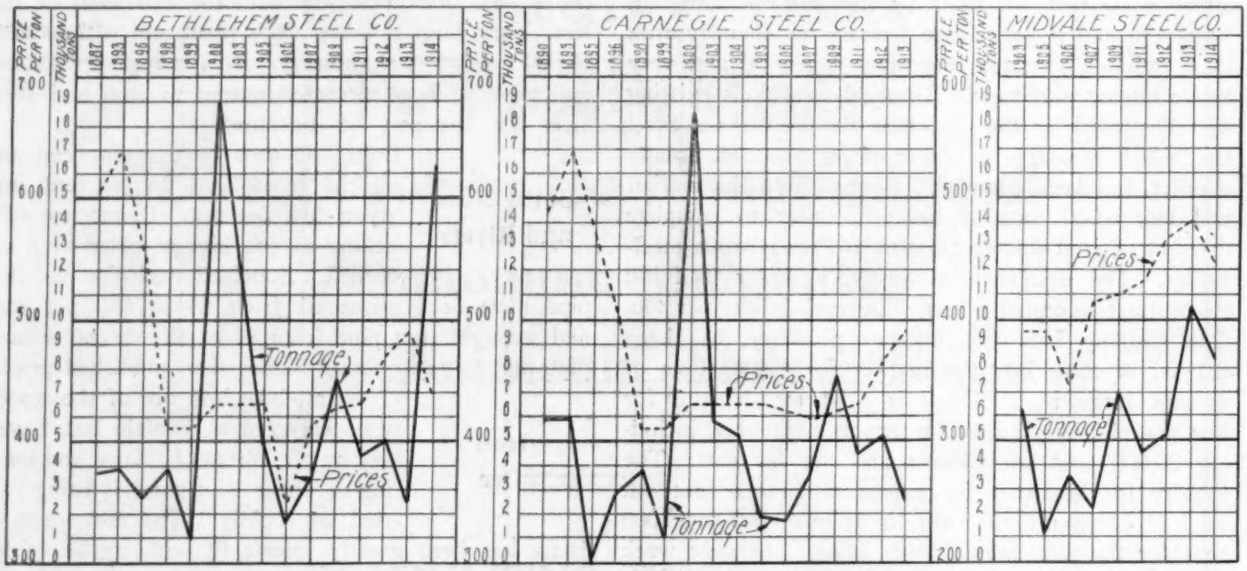

CHART SHOWING GREAT IRREGULARITY OF TONNAGES OF ARMOR PLATE ORDERED AND DOWNWARD TENDENCY OF PRICES, 1887-1914

If the first years of Bethlehem and Carnegie, really an experimental period, are excepted, it will be seen that the average drops at once to $445 per ton. The reduction would be even greater but for the fact that, as the charts disclose, the tonnage involved in those years is moderate.

The charts show graphically the tonnage and prices year by year of each of the three companies. The most striking feature of the Bethlehem and Carnegie charts is the tremendous fluctuation in the tonnage curve.

The lowest point in our armor production, with the exception of the year 1895, when it fell to 95 tons of light armor for the gunboats NASHVILLE, HELENA and WILMINGTON, was reached in 1899. The

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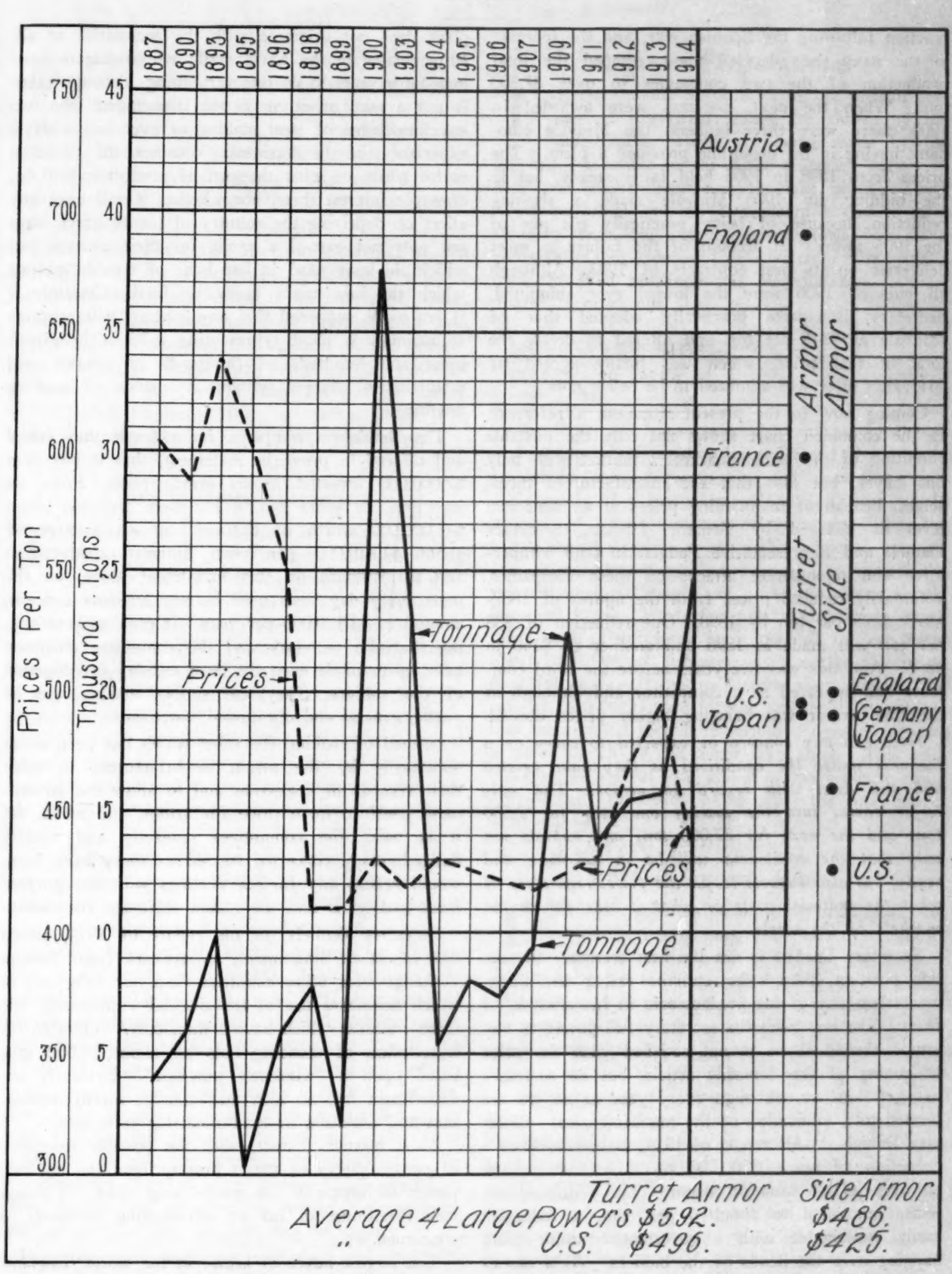

PRODUCTION OF ARMOR PLATE FOR UNITED STATES NAVY, 1887-1914, AND PRICES PAID

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reaction following the Spanish war, and the increase in the navy then decided upon, jumped the total production of the two companies to over 37,500 tons. When the next contracts were awarded in 1903, there were three bidders, the Midvale company having in the meantime provided a plant. The prices from 1898 to 1905 held fairly steady, but in the bidding for 1906 Midvale made a slashing reduction, because of being practically cut out of the 1905 awards on account of the failure to meet deliveries on its first contracts of 1903. Although all bids of 1906 were the lowest ever submitted, Secretary Bonaparte practically adopted that of Midvale at $345 per ton and offered to divide the total at that price, which was finally agreed to. Midvale's offer was admitted to be below cost.

Coming now to the present situation, a reference to the combined chart shows not only the unstable condition of the armor market, a market with only one buyer, but also that the manufacturers themselves, instead of maintaining prices at an abnormal level as charged by Senator Tillman, Secretary Daniels and Representative Padgett in their vituperative and intemperate attacks on these companies, voluntarily reduced prices from the figures of 1887-1893, $225 per ton by 1898. One reduction of $88 per ton was made in 1896 and another of $140 in 1898. And this was five years before the third company had appeared as a competitor and although at the time armor was bringing higher prices abroad.

How can any concern be expected to carry on a business under the conditions as they have existed and still exist with regard to armor? The only buyer comes into the market one year for 2,500 tons and the next for 37,000 tons and expects not only that the equipment will be in existence and ready, but also expects to fix the price, regardless of what the material costs or what it sells for in the markets of the world.

Secretary Daniels is not the first secretary to take this position, though he exhibits rather less judgment than any of his predecessors in his analysis of facts. The law gives the secretary full power to buy armor abroad if he is not satisfied with the price or quality of the domestic article, but no secretary has yet done so, although every year or so we are treated to a vilification of the manufacturers. Secretary Daniels, in his report of 1914, makes much of a reduction of some $700,000 on a second bidding on over 24,000 tons of armor. The reduction actually amounted to about 6 per cent, a reduction easily explainable with a government armor plant hanging over the heads of the bidders. As a matter of fact, this agitation for a government owned armor plant does not originate with the secretaries at all. It originates in the naval staff; whose fingers have itched for years to do this very thing, although there is not a man on it or in the department who has any knowledge of steel making or ever had a day's experience in the business. Whether the plant is worth while, or what the cost of production will be, does not interest them, nor whether it will have any effect on depriving the country of plants which have not only not earned a profit for their owners, but which she may need in her hour of trouble and of which the loss might easily be fatal. Certainly it is not to be supposed that any concern will continue to maintain a plant representing millions in investment and hundreds of thousands in interest and maintenance charges without a chance of earning anything.

The Bethlehem company, for example, has stated and offered to prove its statement, that it has over $7,000,000 invested in its armor plant. Since its inception, 29 years ago, it has been awarded about $41,000,000 worth of business; or an average of about $1,410,000 per year. Interest, depreciation and maintenance on this investment alone, on the most every day basis used by any business concern, amount to $1,120,000 per year. It goes without saying that the secretary and the committee chairmen have never made even the most cursory investigation of the subject. They are simply making use of vague, general and unfounded statements.

Instead of making the offer which has been made voluntarily by the armor manufacturers to open their records to inspection and to allow the government itself to fix a price for armor, and which, let it be said, the committees carefully and timidly dodged, many concerns, treated as these have been, would refuse any further dealings with the government and let it and the nation shift for themselves.

Secretary Daniels, in his report of 1914, which has furnished amusement, as appears from foreign exchanges, for other countries than our own, and in which he makes use of the singular expression, "the three concerns which have a monopoly," refers to his expectation of securing bids on about 24,000 tons based upon a "wholesale purchase". Evidently the department had an idea that tonnage meant duplication and admitted of manufacturing processes.

As a matter of fact, with the possible exception of certain pieces of turret armor, there are not two pieces of armor in an entire ship alike. Tonnage means nothing so far as advantaging processes is concerned.

The largest buyer of armor in the world, England, has always seen the advantage of private plants and

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is now reaping the reward. Where would she be today if such suicidal notions as seem to possess congress had guided her government?

That the armor makers, in such a market as exists today for their entire capacity, are willing to make the offer which they have submitted should be to their everlasting credit and the government should quickly accept it.

When John Fritz and Andrew Carnegie, at the solicitation of the government, undertook to make the United States independent in the matter of armor, it is safe to say that, had they been able to look into the future and see the attitude of the government toward the plants which for years they operated at heavy loss, they would have saved their money and allowed foreigners the "inordinate profits" to which Secretary Daniels is so fond of referring.

The Fight on Efficiency

THE dangers of the assault on private industry, masked behind the Tavenner bill prohibiting scientific methods of shop management in government-owned shops, have been repeatedly emphasized during the past few weeks. The only means of averting this danger—that of arousing the manufacturers themselves to a sense of their personal responsibility in calling their congressmen's attention to the bill's pernicious character—have not met success. They now have an opportunity to endorse the splendid stand taken by Secretary Baker against the bill. Write to Secretary Baker and to your congressman, commending the former and urging the latter to vote against the bill.

A disinterested study of the arguments advanced both for and against the bill cannot fail to excite wonder that any possibility of the bill's passage still exists. Exactly why this possibility has become a probability, however, is clearly set forth by William Kent in his article on page 939. His contribution is not only a notable addition to the increasing array of irrefutable arguments against the bill, but it makes clear the reasons for congressional apathy. The refusal of congress to grant an open-minded hearing to the small group of protestants is revealed by Mr. Kent. The suggestion he advances of delaying action until an impartial investigation can be made, must appeal to all for its fairness. It shows that the opponents of the bill fear nothing from such an investigation. Its rejection by the bill's proponents will indicate that they do fear such an inquiry.

For your own good, we urge that you read Mr. Kent's article. The fight which he is leading for the private manufacturer needs recruits.

Gigantic Preparations

THE tremendous possibilities of the present season on the Great Lakes are shown by the preparations which are being made by the railroad companies in the Lake Superior region to haul ore from mines to upper lake ports. These schedules, which are based on statements as to sales made by the mining and selling companies, now stand about as follows, compared with the shipments actually made in 1915, not including Mayville and Baraboo districts:

	Estimate for 1916.	Shipments for 1915.
Duluth, Missabe & Northern; Grt. Northern; Duluth & Iron Range	47,500,000	31,490,284
Cuyuna range	1,750,000	1,136,113
Gogebic range	6,500,000	5,477,767
Menominee range	6,000,000	4,982,626
Marquette range	4,500,000	4,105,378
Total	66,250,000	47,192,168

At Duluth, the opinion is expressed that should no link be broken between mine and lower lake ports, the estimate of a movement of 66,250,000 tons could be realized. It is also confidently asserted that the mines are in shape to produce this immense tonnage. We believe, however, that even if the mines, the railroads in the mining country and the vessels should be equal to this wonderful task, the railroads which must haul a very large percentage of the ore from lower lake docks to furnaces would not be able to do their full share. If the ore were to come down at the rate of 66,000,000 tons for the season, it is probable that there would soon be a serious congestion of cars at some or all of the lower lake ports. This will, however, be a great year and it is dangerous to make very definite prediction as to what the total movement will be.

A Courageous Club

THE Manufacturers' Club of Philadelphia deserves the hearty congratulations of the business men of the country. If the government should decide to build an armor plate plant, Philadelphia would undoubtedly be a candidate to be selected as the site and the false notion of local pride which generally prevails would dictate that no local organization should even whisper anything that would be antagonistic to the plans of the national government. But the Manufacturers' Club of Philadelphia has had the courage to adopt resolutions, which have been sent to congress and to the executive departments of the government, unqualifiedly condemning the proposed action of congress and declaring that it is not only unnecessary, but is a "severe blow at the much needed increase and strengthening of our navy."

There still is a chance for other organizations to fall in line and the defeat of the bill is possible.

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products April 26, average for March, 1916, average for January, 1916, and average for April, 1915. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Apr. 26, 1916.	Aver. for Mar., 1916.	Average for Jan., 1916.	Aver. for April, 1915.
Bessemer pig iron, Pittsburgh	$21.95	$21.55	$21.32	$14.55
Basic pig iron, Pittsburgh	19.20	19.20	19.20	13.45
No. 2 Fdy. pig iron, Pittsburgh	19.70	19.45	19.95	13.45
Northern No. 2 Fdy., Chgo.	19.00	18.70	18.50	13.00
Lake Superior Charcoal, Chgo.	19.75	19.75	19.25	15.75
Mall. Bess., Chgo	19.50	19.20	19.00	13.00
Southern No. 2, Birmingham	15.00	15.00	14.50	9.35
Southern Ohio No. 2, Ironton	18.50	18.50	18.00	12.75
Basic, eastern Pa.	20.50	20.00	19.50	13.25
No. 2X Virginia furnace	18.50	18.00	17.50	12.50
No. 2X foundry, Philadelphia	20.75	20.00	19.75	14.25
Ferro mang., Balti., (1917)	175.00	175.00	110.00	100.00
Bessemer billets, Pbgh.	45.00	40.60	33.75	19.50
Bess. sheet bars, Pbgh.	45.00	41.00	33.75	19.60
Op.-h'th sh. bars, Pbgh.	45.00	41.00	34.75	19.50
Open-hearth billets, Pbgh.	45.00	40.60	34.75	19.60
Steel bars, Chgo.	3.10	2.50	2.03	1.38
Steel bars, Pittsburgh, contr.	2.50	2.34	1.865	1.20
Iron bars, Philadelphia	2.559	2.559	2.259	1.20
Iron bars, Cleveland, local del'y.	2.40	2.40	2.00	1.20
Iron bars, Chgo. mill	$2.35	$2.19	$1.83	$1.15
Beams, Chgo.	3.10	2.50	2.03	1.38
Beams, Pittsburgh, contr.	2.50	2.40	1.865	1.15
Beams, Philadelphia	2.659	2.659	2.159	1.35
Tank plates, Pbgh., contract	2.90	2.34	1.875	1.11
Tank plates, Chicago	3.50	3.15	2.05	1.38
Tank plates, Philadelphia	3.809	3.409	2.409	1.35
Sheets, blk., No. 28, Pbgh.	2.90	2.75	2.58	1.80
Sheets, blue an., No. 10, Pbgh.	3.00	2.87	2.45	1.30
Sh., galv., No. 28, Pbgh.	5.00	4.82	4.75	3.30
Wire nails, Pittsburgh	2.40	2.38	2.125	1.59
Connellsville fur. coke, contr.	2.90	2.80	2.38	1.65
Connellsville fdy. coke, contr.	3.50	3.60	3.75	2.25
Heavy melting steel, Pbgh.	18.00	17.95	17.50	11.90
Heavy melting steel, east'n Pa.	17.50	17.50	17.00	11.25
Heavy melting steel, Chgo.	16.75	16.20	15.50	9.30
No. 1 wrought eastern Pa.	23.00	22.50	22.25	12.50
No. 1 wrought, Chgo.	16.75	16.15	15.50	8.55
Rerolling rails, Chgo.	17.75	17.20	17.70	9.85
Car wheels, Chgo.	13.50	14.05	14.75	9.80

(For Additional Prices See Page 960.)

Pig Iron Makers Become Buyers

Bethlehem Steel Co. and Reading Iron Co. Place Orders—Active Demand for Low Phosphorus Pig for Export—Bessemer Sale at Pittsburgh

Philadelphia, April 24. — Buying of iron by large producers to meet requirements in excess of their output is the market's most interesting and perhaps significant feature. In one important case, steelmaking iron was bought to fill orders for second quarter delivery which the purchaser had taken several months ago from other eastern Pennsylvania consumers and now is unable to ship. Considerable loss was accepted to cover these obligations. The Bethlehem Steel Co. bought 6,000 tons of prompt basic from an eastern Pennsylvania furnace to complete an order from a Coatesville consumer. The price was $20, delivered, or about $19.60, furnace, which is lower than the recent minimum of the market had appeared to be, but the circumstances were exceptional since the iron is to apply against a $17.50, delivered, order. The Bethlehem Steel Co. also asked for 5,000 to 6,000 tons of basic to cover other orders with eastern Pennsylvania steelmakers, but it probably will not buy and will ship its own iron instead. Duplexing operations necessitating increased needs of iron for its own purposes are understood to have forced this maker to turn buyer. The Reading Iron Co., whose Keystone and Emaus furnaces have been slower in resuming than it had anticipated, has inquired for 10,000 tons of prompt mill forge for its own use and has purchased about half this quantitiy at about $19.50, delivered. Apart from these rather unusual transactions, the market has remained quiet. Some makers still offer prompt basic at $20.50 to $20.75, delivered. A Lebanon, Pa., consumer asks 500 to 1,000 tons. An interesting aspect of the low phosphorus iron market, is the active inquiry from foreign buyers for next year's delivery. About 20,000 tons from Canada and the far east has come out, but makers do not care to sell for export so far ahead. There is also a foreign inquiry for 10,000 tons of bessemer for delivery alongside at Philadelphia. Fair selling of low phosphorus iron for both this year and first half to domestic buyers, is continuing at $34 to $35, Philadelphia basis, a tidewater consumer taking 3,000 to 4,000 tons. Foundry iron prices are stronger at $20.50 to $21, Philadelphia, for No. 2X. One eastern Pennsylvania maker recently has disposed of a total of about 2,500 tons on the basis of $21, furnace, or $21.79, Philadelphia, for No. 2X. Virginia iron shows no change. The Pennsylvania railroad has taken 1,100 tons of charcoal and high manganese iron.

Buying Quietly

New York, April 25.—Activities by large buyers on which extra efforts are being made to keep details from becoming known, continue to monopolize first interest in the market, and it is apparent that a significant movement is under way. Some heavy sales already have been put through for last half of this year and first half of 1917, in which Buffalo makers have shared largely. Current reports place the total of these sales at not less than 100,000 tons, and perhaps greatly in excess of that figure. The American Radiator Co., which has been figuring on a large tonnage for last half of this year and first half of next, has closed with Buffalo and other makers, but the total amount of its purchase is not clear. One estimate gives it as over 50,000 tons. Other large buyers have taken 50,000 tons from Buffalo with the result that some makers there now have little unsold iron for this year and have advanced No. 2X and higher grades to $19.50 and $20, furnace. Two buyers in this district are quietly figuring on 5,000 to 10,000 tons each, one of which is a revival of a former negotiation. It is reported that leading Connecticut malleable interests again are in the market. A tremendous amount of foreign inquiry is current. The recent request for an

(*For complete prices see page* 950.)

unfixed tonnage of bessemer from J. P. Morgan & Co. for France now has been defined as 5,000 to 10,000 tons monthly for the remainder of the year, or 40,000 to 80,000 tons. Action is expected in a few days. Other inquiries include two lots of 10,000 tons of bessemer each and 3,000 and 5,000 tons of low phosphorus for Italy; 10,000 to 15,000 tons of low phosphorus for the far east; 7,000 tons of foundry for Glasgow; 10,000 tons of bessemer and 6,000 tons of low phosphorus for France and 1,000 tons of foundry for South America. A sale of 500 tons of foundry to South America is noted.

Sales Nearly 100,000 Tons

Buffalo, April 25.—Furnaces of the Buffalo district booked orders in the past week for a total of 90,000 to 100,000 tons. The heavy sales followed the inquiry that came into the market as noted a week ago. A portion of the tonnage placed is made up of a part of the inquiry of the American Radiator Co. for about 30,000 to 35,000 tons of foundry grades. None of the heavy placement, it is stated by the furnace interests here, is made up of the export inquiry for bessemer iron.

The sales made include the orders of a large number of melters supplied from the Buffalo district and considerable of the tonnage is for extended deliveries.

Considerable Sub-Surface Activity

Pittsburgh, April 25.—Sales of steelmaking pig iron grades the last few weeks have been much heavier than published reports have indicated. The Jones & Laughlin Steel Co., it develops, about a month ago closed for a heavy tonnage of basic iron through a Pittsburgh broker. It is estimated that not less than 50,000 tons was involved. The Republic Iron & Steel Co., as briefly indicated a week ago, took 15,000 tons of basic iron at $18, valley, or 25 cents a ton under the published market price. A local foundry interest has closed for 19,000 tons of bessemer iron, mostly for second half shipment. Some of the pig iron sellers here report that they have quietly disposed of decidedly heavy tonnages of steelmaking grades during the last 40 days.

Much of the basic iron recently sold for prompt delivery will be furnished by the Pittsburgh Steel Co., which operates two blast furnaces at Monessen, Pa. It is understood that both stacks have been breaking all previous production records, enabling the company to offer approximately 15,000 tons of pig iron a month for fairly prompt shipment. As the company will complete two additional 80-ton open hearth furnaces about July 1, it is believed that it will not be able to figure in the pig iron market after that date. Dealers believe that prices of basic iron will advance sharply after this tonnage is no longer available.

Higher Cleveland Prices

Cleveland, April 25.—The Cleveland Furnace Co. has advanced its price on malleable, basic and No. 2 foundry to $19.50, furnace, for delivery either in Cleveland or outside the city limits. This makes the delivered price $19.80, Cleveland, an advance of 30 cents over the previous quotation. Another firm is selling at $19.30, delivered, Cleveland, and is understood to be selling below $19, furnace, for delivery outside the city. There is not very much activity in pig iron in the immediate Cleveland district, but demand for delivery outside the district has resulted in one firm selling about 120,000 tons this month.

Chicago Market Strong

Chicago, April 25.—Conditions in the northern pig iron market are somewhat irregular with prices holding strongly and every condition pointing to a higher level. The only influence preventing this action seems to be weakness in the southern market, which is pronounced. It appears that local producers already have booked more than half their tonnage for last half and that only a minor fraction remains unsold.

Northern No. 2 foundry is still quoted at $19 and malleable at $19.50, Chicago furnace. An increase of at least 50 cents per ton is imminent.

Inquiry now current approximates 50,000 tons and practically all seems to be in earnest. Melters continue to come into the market speedily and contracting is going on continually.

Resale iron from southern furnaces is credited with the present situation in the south and frequent instances are met of direct competition by warrant iron. Some southern furnaces are refusing to shade $15.50 for first half and $16, Birmingham, for last half delivery. In spite of this, at least 50 cents per ton lower than these figures seems possible to obtain in more than one direction. An unusual relation between Birmingham iron and that from stacks at Ironton, is a matter of comment.

A St. Louis user recently took 5,000 tons of prompt basic from a Chicago stack at about $18.50, furnace, but this transaction is modified by other considerations which prevent it being illustrative of actual conditions. The general market for basic is firm at $19.50, furnace.

Lake Superior charcoal iron is unchanged and demand and sales continue excellent.

(*For complete prices see page* 950.)

Pig Iron Slow

Cincinnati, April 25. — The pig iron market continues to drag, with sales and inquiries at a lower stage than at any time since the first of the year. General inquiry from melters in this territory is at a minimum, and the only business being figured upon by local dealers is from users in surrounding territories, and a few lots that have been secured by salesmen through private solicitation. Sales made last week by one large house in this city aggregated only 3,000 tons. Prices remain strong. Southern Ohio silvery iron is holding at the recently advanced price of $29, furnace, for 8 per cent silicon. Southern Ohio foundry and basic iron are quoted at $19, Ironton basis, for 1916 delivery, but very little basic iron is available. Foundry iron for the first half of 1917 has also been sold at $19. Southern Ohio resale iron is available at $18.50. Southern No. 2 foundry is unchanged at $15, Birmingham basis, for the first half, and $15.50 for the second half. Prices for the first half of 1917 are given at from $15.50 to $16, Birmingham basis.

Birmingham Market Quiet

Birmingham, Ala., April 25.—With three furnace interests off the active selling list and many consumers well supplied, a quiet iron market is not regarded as significant. All makers admit a maximum of $15.50 for second half. The leading interest quotes $15 for spot and the others, with some exceptions, meet that price when necessary to retain customers. Items of the week have been sales of 1,000 tons for second half at $15.50, 275 tons of high manganese at $17 and 300 of high silicon at $16. An eastern buyer took 4,500 tons of spot at $15, but other lots of spot went at $15.50. One interest is reported as having offered 1917 delivery at $16 without affecting bookings. Some additional basic has been sold on the basis of No. 2 foundry. Consumers are ordering out iron on time and some are asking for earlier shipments. The inquiry has not been heavy. Basic is apparently in increasing demand and makers look for higher prices owing to the gradual disappearance of steel scrap.

The Woodward Iron Co. expects to get its Vanderbilt stack of 150 tons capacity in blast within 60 days, when No. 1 Woodward will go out for repairs. The big 400-ton Woodward

stack goes on basic July 1 for the rest of the year and indefinitely thereafter. It would go on basic now but for the bookings of foundry which must be gotten out of the way first. The Sloss-Sheffield is to blow in its second Birmingham city stack in the near future. Delays in receiving blowing engines, gears, etc., will probably delay the coming in of the new Sheffield stack of the Sloss-Sheffield and that of the Alabama company at Gadsden.

The big buyers have not sounded the market in some time. Cost of manufacture now in Alabama is around $9 and most makers prefer a market that rises of its own weight. Some resale iron is reported as going slightly under furnace metal, but no Birmingham furnaces are believed to be undercutting the prevailing quotations of $15, spot, and $15.50, second half.

Pipe Advanced

For the Seventh Time Since Jan. 1— Prices Up Two to Five Points

Pittsburgh, April 25.—Under date of April 21, the National Tube Co. advanced standard steel pipe and line pipe from two to five points and the A. M. Byers Co. and the Reading Iron Co. put up prices of wrought iron pipe from two to four points, a point being equivalent to about $2 a ton. Tubing, casing and drive pipe and boiler tubes, which were advanced in price April 15, were not affected by changes announced April 21.

Black steel pipe was put up from two to five points and galvanized steel pipe from three to four points. Butt weld black iron pipe was put up two points and lap weld black iron pipe, from two to three points. Galvanized butt weld iron pipe was advanced three points and galvanized lap weld iron pipe was advanced three and four points. Seven advances have been made in the price of steel pipe this year.

For the first time since the formation of the Corporation, some of the independent welded pipe manufacturers recently have been disregarding published quotations of the leading interest, quoting standard pipe and oil country goods at prices slightly above those generally accepted as representative. The Wheeling Steel & Iron Co. on April 17, distributed cards on standard pipe providing prices from one to three points above those offered by the National Tube Co. card, issued under date of March 29.

An order for 1,000 tons of 6-inch line pipe has been placed with one of the mills in this district.

Cast Iron Pipe

Decision Not Reached on the Large Tonnage for Rochester

New York, April 25. — No decision yet has been reached by the City of Rochester between iron and steel pipe for a large requirement upon which it recently took bids. On the 12,000 tons of 37-inch cast iron pipe the United States Cast Iron Pipe & Foundry Co. is low with the bid of $26.90, delivered, for the pipe and $60, delivered, for the specials, or a lump sum of $326,110. The Warren Foundry & Machine Co. on a bid for 6,000 tons, is low at $26.65, for the pipe, and $59, for the specials. The lump sum of the total low bid for iron pipe together with the laying amounts to $456,310. T. A. Gillespie & Co. have submitted a bid of $412,030 for furnishing and laying steel pipe. R. D. Wood & Co. have received 1,305 tons for Philadelphia at $20.50, delivered, for the 6's; $20.90 for the 8's and $20.80 for the 36's. The same shop is low at $28.94 on 315 tons of 8 and 12's for the Borough of Manhattan, and Warren Foundry & Machine Co. is low on 475 tons of 8-inch for the Borough of Queens at $41.50 to $41.80, delivered.

Cities Buy Little Pipe

Chicago, April 25.—Lack of inquiry for cast iron pipe for waterworks extensions on the part of cities continues to be the feature of the market. Were it not for unusual demand for specials for industrial work, principally chemical and mining, shops would have comparatively little on which to work.

Bids were opened April 24 at Antigo, Wis., on 225 tons and at Lakewood, O., April 25, on 200 tons. Bids will be taken May 1 at Middletown, O., on 200 tons.

Highland Park Award

Detroit, April 25.—The American Cast Iron Pipe Co., of Chicago, has been awarded the contract for the 1,400 tons of cast iron pipe for Highland Park. The price was $30 per ton, delivered. The American Car & Foundry Co., Detroit, was awarded the specials at 3 cents per pound.

Marked Up $1

Birmingham, Ala., April 25.—One of the large pipe interests marked up prices $1 the past week, and, upon inquiry, it was stated that the advance was warranted by the increased strength of the market. The South American bookings by the Birmingham makers are said to approximate 15,000 tons with much more in sight dependent upon ship room. Settlement of wage disputes in the Anniston sanitary soil pipe field has bettered conditions there and the output will be increased. Water and gas pipe orders have come in with sufficient volume to render the outlook very good. Soil pipe makers are beginning to sound the market for spring warehouse supplies.

(For complete prices see page 950.)

Metal Markets

Spelter Shows Weaker Tone — Lead Prices Marked Down

New York, April 25. — The continued strength in copper has been the feature of interest in the metal markets during the week. Demand for copper has been steady and of good-sized proportions, and a large volume of inquiry, including a large tonnage for export to Italy, now is pending. Prices have displayed a further upward tendency and first hands now quote prompt electrolytic at 30c to 31c, delivered 30 days; sales are reported at higher levels occasionally, while second hands offer prompt at slightly higher than 30c, cash. Electrolytic for July and August is quoted at 28.75c to 29.25c, delivered 30 days, and beyond August at 28.25c to 29c, delivered 30 days. Ordinary and arsenical lake copper for June and July shipment have sold at 29.50c, cash. Ordinary casting copper is quoted at 27.75c to 28.25c, cash.

The spelter market has been characterized by a reactionary tone, due to the growing disinclination of consumers to contract for future supplies, and to the government's report last week, which showed the extent to which the production has been increased in this country. Prime western now is quoted: Prompt and April, 18c to 18.25c, St. Louis; May, 17.25c to 17.50c; June, 16.75c to 17c; third quarter, 15.50c to 15.75c; second half, 14.50c to 14.75c. Ordinary brass special spelter for prompt shipment is quoted at 21c, St. Louis.

The lead market is quoted lower, due to lower offerings on the part of second sellers as well as producers. The former are offering carloads at around 7.25c to 7.37½c, St. Louis, and 7.37½c to 7.50c, New York, while none of the producers now are offering higher than 7.50c, New York. The American Smelting & Refining Co. continues to quote 7.50c, New York. The feature of interest is the improvement in the volume of export inquiry; among these is a large tonnage for England which is expected to be closed shortly.

There has been a fair volume of business in tin at declining prices. Fears of a scarcity of the metal are not so pronounced, as the metal is coming forward from England in greater volume. This condition is reflected in the wide spread between the prices of spot and May. Spot and April are quoted at 49.50c, New York, May at 46.50c and June at 54.50c.

The growing disinclination of consumers to contract for futures, as well as a limited demand for prompt and nearby, is responsible for a weak tone in the antimony market. Spot antimony is quoted at 39c to 40c, New York.

No. 2 rail mill at the Edgar Thomson Works of the Carnegie Steel Co., at Braddock, Pa., was put into operation, April 23.

Many Rail Orders Placed

Capacity of Mills Will Be Taxed– High Prices of Cars Check Buying by Some Companies

New York, April 25.—As the first of May approaches, when the advance in steel rail prices will go into effect, many of the railroads continue to hurry forward rail orders for delivery after Jan. 1, 1917. In view of the heavy tonnage of rails that has been placed for 1916 delivery, it probably will be beyond the capacities of the mills to fill these orders before July 1, 1917, but no advance is to be paid on a large proportion, if not all of these, even where the shipment will be subsequent to May 1, 1917. Independent makers have sold freely at the old prices for first half of next year and some of them now report that their capacity is filled for that period. Some of the mills have been declining orders for thousands of tons of rails at the old prices because they could not be rolled within the delivery period stipulated by makers.

The Burlington railroad, which recently placed a considerable tonnage for next year, has closed for 50,000 to 75,000 tons, additional, for new construction with the Steel Corporation and independents. The Reading has increased its recent order from about 15,000 to 25,000 tons, dividing it among the Bethlehem, Carnegie, Lackawanna and Pennsylvania Steel companies. The Great Northern purchase of 30,000 tons gives the Steel Corporation 15,000 tons; the Lackawanna Steel Co., 10,000 tons, and the Bethlehem Steel Co., 5,000 tons. The Lehigh & New England has placed 3,000 tons additional with the Bethlehem Steel Co.; the Lake Superior & Ishpeming, 3,500 tons, with the Illinois Steel Co.; the Pere Marquette and the Clover Leaf are reported to have closed against inquiries of 15,000 and 5,000 tons, respectively. The Southern and the Chesapeake & Ohio railroads have placed additional tonnages. The Havana Central has ordered 5,000 tons of bessemer rails from the Steel Corporation. Specifications for the recent Pennsylvania order still have not been determined, but it is anticipated there will be no radical changes over former years.

Bar business is light. It is ascertained that car builders now are quoting on cars with an average basis of 2.60c to 2.65c, Pittsburgh, for plates, shapes and bars, and 4c for axles, which furnishes an eloquent explanation why some of the roads now hesitate to place orders. It now is confirmed that the Wabash has placed its order for 1,000 car bodies with the American Car & Foundry Co. Corrigan, McKinney & Co. have placed six hoppers with the Pressed Steel Car Co. The Southern railway has increased its recent order for locomotives with the Baldwin Locomotive Works from 25 to 40; the Frisco has ordered 10 additional from the same builder.

Light Rails Higher

Chicago, April 25.—An advance of $2 per ton on light rails, making the base price 1.80c, Chicago mill, has just been announced. This leaves light rails in the west considerably lower than the same material at Pittsburgh, but conditions of the mining industry in the two centers account for this.

No further sales of standard steel rails have been made in the past week as the local mill is sold for delivery beyond the point on which former quotations could apply and practically nothing is being bought at the new figures for delivery after May 1, 1917. Few small tonnages involving only a few carloads have been sold at the new quotations. These go to small railroads whose business never is a feature.

Car Buying Slack

Chicago, April 25.—Car builders are entertaining only one inquiry at present of sufficient size to be noted. This is from the Louisville & Nashville railroad and calls for 1,750 steel underframes, involving about 4,500 tons of steel.

Other inquiries for cars, recently withdrawn, have not been reinstated and with advancing prices of steel their reappearance does not seem likely.

Great Demand for Brick

The development of the by-product coke oven industry has lead to a tremendous demand for silica and fire clay brick, shipments of which recently have been breaking all previous records. More important manufacturers of refractory material say they have been unable to build up stocks of either silica or fire clay brick, although most makers are in a position to meet specifications for fairly prompt delivery. In the construction of a 15-ton retort oven, on the average of 20,000 fire clay brick and 20,000 silica brick are used. Silica brick now is commanding $25 per 1,000, or about $7 per 1,000 above the prevailing price 12 months ago.

Demand for fire brick for blast furnace use also is very heavy and prices have advanced $3 or $4 per 1,000 during the last year. Fire brick now is quoted at about $22 per 1,000.

(*For complete prices see page* 950.)

Sheets Strong

But Quotations Show Considerable Irregularity

Pittsburgh, April 25. — The general market for steel sheet products reflects strength, some mills being able to sell material at $2 and $3 a ton above prevailing minimum prices. Some irregularity is reflected by galvanized sheets, which have been offered at less than 5c, base, for the heavier gages. Not more than 35 per cent of the galvanizing capacity of the independent sheet mills of the country is engaged, due to the abnormally high prices of spelter the last 10 months. No. 28 gage bessemer black sheets are frequently commanding above 3c, although the 2.90c figure has not disappeared. Blue annealed sheets are selling at as high as 3.25c for No. 10 gage, in some instances, although the bulk of the tonnage is being offered at prevailing market prices.

Want Little Business

Philadelphia, April 24.—Little new business is being accepted by eastern Pennsylvania makers of sheets, as their present bookings will carry them well along to the close of the year. Their schedule remains 3.75c to 4c, Pittsburgh, for No. 10 gage blue annealed or 3.909c to 4.159c, Philadelphia.

Tin Plate High

Pittsburgh, April 25. — No trace of sales of tin plate at less than $5, base, can be found. If mills were in a position to figure in the market for prompt delivery, it is apparent that they could obtain considerably above $5 a box. Some jobbing concerns are selling material on the basis of $5.25 a box, one sale having been made of 20,000 base boxes at $5.50. As pointed out in last week's issue of *The Iron Trade Review*, tin plate has been selling at the highest figure obtained since the early history of the industry in the United States. Demand for export continues active, but no large tonnages have been booked by mills in this district this week.

E. L. Leeds, manager of sales of the Niles-Bement-Pond Co., 111 Broadway, New York, left on April 26 for Florida, where he is spending two weeks in tarpon-fishing.

Strip Steel

To Be Made Cold-Rolled at New Warren, O., Plant

Pittsburgh, April 25.—Manufacturers of cold-rolled strip steel have announced that they will not permit consumers to cancel contracts for future delivery; they also have declined to protect buyers against future declines in prices. Fairly heavy tonnages of strip steel are being sold at 6c and some mills are obtaining as high as 8c. The bulk of the tonnage is selling at a range from 6c to 6.25c.

The Trumbull Steel Co., Warren, O., has completed plans for equipping a cold-rolled strip steel department, which will house from 16 to 20 stands of mills for rolling popular sizes of strip steel. Contracts for some of the equipment have been awarded.

Coke is Weak

Foundry Grades for Spot Delivery Show Sharp Decline

Pittsburgh, April 25. — Despite a partial cessation of operations at many plants in the Connellsville regions, caused by the observance of Easter, the market for Connellsville coke has failed to reflect any strength this week. Blast furnace fuel for prompt delivery continues to be offered as low as $2.25, ovens. Foundry coke, which had been commanding as high as $4.25, ovens, now is available at $3.50, ovens, for spot delivery and reports are heard that some dealers have sold 72-hour fuel at $3.25, ovens, for eastern delivery. Three of the more important makers of foundry coke have withdrawn from the market for delivery before July 1, 1917. *The Connellsville Courier,* for the week ending April 15, says production of coke in the upper and lower Connellsville regions was 642,920 tons, a decrease of 2,742 tons, compared with the week before.

Sales Lighter

Cincinnati, April 25.—Sales of foundry coke, which have been very heavy during the past month, are slowing up, due to the fact that foundries in this territory are mostly covered for yearly requirements beginning July 1. Sales of furnace coke are light and usually for spot requirements. Prices are unchanged and fairly strong.

Firm in South

Birmingham, Ala., April 25.—The coke market remains very firm at the advanced prices. Brookwood hand-picked rules at $4.50 and Yolande at the same price. The Woodward company has blown in 300 beehive ovens, but uses the supply itself pending repairs on by-product ovens. The Pacific coast demand is greater than it has ever been owing to the complete absence of English and German coke. Southern foundries are also greater consumers. Altogether the southern coke market is strongest of all with the exception of steel. The railroads are meeting the situation much better than anticipated and movements are curtailed very little at this time. Furnace coke may be had at $3 to $3.50, f. o. b. ovens.

Nuts and Bolts

Are Again Advanced—Rivets Marked Up $10 Per Ton

Pittsburgh, April 25.—Leading manufacturers of nuts and bolts last week put up prices from 10 to 15 per cent. Rivets, which had been nominally quoted at 3.25c for structural rivets, were advanced to 3.75c; most mills, however, had been quoting 3.50c for structural rivets for several weeks. Last week's advance was the sharpest made during the upward movement of the market, which began about 12 months ago, when structural rivets were quoted at 1.45c. It is interesting to note that both rivets and steel bars have advanced $26 a ton during the last 12 months.

First Ore Cargo

Brought to Buffalo by the Willis L. King—Sale of Low Phos Ore

Cleveland, April 25.—The opening of navigation on the Great Lakes has been proceeding rapidly the past week in spite of some difficulties. Owing to the presence of ice and fog, a number of ships have already been reported stranded, but there has been no loss of life and the stranded boats have not been very seriously damaged. Owing to the stringent provisions of the new seamen's law, some trouble is being experienced in getting certified seamen. The first cargo of iron ore was brought down by the WILLIS L. KING, which arrived at the port of Buffalo, Saturday, April 22. This ore, which was loaded at Escanaba, was consigned to Oglebay, Norton & Co. The steamers BRAZIL and AMAZON arrived at Cleveland from Escanaba Monday night with the first ore of the season delivered in that city. Ore is being loaded rapidly at Duluth, where more than a million tons have already been shipped.

One Cleveland firm has sold 35,000 tons of low phosphours ore, for which there is a demand in excess of the supply, owing to the active buying of low phosphorus pig iron for export.

(For complete prices see page 950.)

Wire Prices

Are Expected to Advance — Export Shipments Not Heavy

Pittsburgh, April 25.—An advance of $2 a keg in the price of cement-coated nails, announced last Saturday, is believed to foreshadow a general advance in the price of wire products. Cement-coated nails now are quoted at $2.50 a keg, or $2 above the minimum price of wire nails. No formal announcement has been made by the American Steel & Wire Co., but it generally is believed that an advance in the price of general wire products will be made before the end of the week. Specifications are coming out in tremendous volume and some new buying is enjoyed. Most mills are not anxious to book additional tonnage for future delivery. Export shipments are not heavy, because of the congested traffic situation in the east and the extreme difficulty of obtaining bottoms.

Ford Plant

To Manufacture Tractors Will Be Built at Head of Newark Bay

Henry Ford has decided to locate an eastern automobile manufacturing plant to manufacture and assemble the Ford tractor on the property of the Newark Factory Sites, Inc. The announcement has been made by Joseph P. Day, of 31 Nassau street, New York, the broker in the transaction.

The property purchased by Mr. Ford consists of 80 acres located at the head of Newark bay at the confluence of the Passaic and Hackensack rivers, midway between Newark and New York City, within five miles of the city hall of Manhattan. According to the tentative estimates, the first unit of the plant will cost approximately $1,000,000. The project as a whole will involve the construction of four other units and the ultimate investment of approximately $5,000,000.

Warehouses Busy

Cincinnati, April 25. — Warehouse business is very brisk and deliveries are being handicapped because of inability to get finished materials from the mills. Demand is centered mostly around building materials. Prices are unchanged, but very strong. Cold-rolled bars are quoted at 20 per cent plus the list price, and hot-rolled bars at from 3.20c to 3.75c. No. 10 blue annealed sheets are quoted at 3.50c, black No. 28 at 3.95c, and galvanized No. 28 at 5.65c.

More Plates for Ships

Annual Requirements of the Sun Co. Will Be Large—Very High Prices Prevail, Especially for Heavy Plates

Philadelphia, April 24. — Shipyard needs still are demanding a record-breaking tonnage from eastern Pennsylvania platemakers. A new inquiry is out for about 10,000 tons of plates for delivery during the third quarter for the Sun Co., which is to establish a large shipyard near Chester. The annual requirements of this yard are estimated at 60,000 tons, of which about two-thirds will be of plates. The problem of eastern platemakers is to supply the needs of their regular customers only, which are tremendous. At least one mill is oversold for this year. There is some selling for delivery next year, but only on specific requirements and not on contracts. Small lots for early delivery were sold the past week at 5.50c, Pittsburgh, and there is not much difficulty in obtaining this figure. One large producer is naming a flat price of 4c, Pittsburgh, at which it can promise fair deliveries. A minimum quotation of 3.75c, Pittsburgh, is being made by eastern makers for delivery as they are able, which means a matter of months.

High Prices for Heavy Plates

Cleveland, April 25.—The demand for plates continues very active, especially for the heavier gages, which are sold without difficulty for fairly early delivery at 4c to 4.50c, while the lighter gages are sold on a basis of 3.50c as the minimum. Some plates have been sold by an eastern mill at 4c for January delivery. The Carnegie Steel Co. continues to quote 2.90c.

Chicago Plates Higher

Chicago, April 25.—An advance of $3 per ton has been made on plates, bringing the present quotation to 3.19c, Chicago mill. This advance makes the differential between plates and bars $8 per ton, which is an unusually wide spread and is brought about from heavy demand for plates to go into ship building and for other purposes.

Prices Trend Upward

Pittsburgh, April 25. — Decidedly heavy demand continues for steel plates. While no formal advances have been made, yet it is apparent that prevailing minimum figures gradually are disappearing. Some mills continue to offer material at 2.75c for delivery at their convenience, but others are asking 2.90c as a minimum to all consumers, except car builders, who are still able to cover requirements without difficulty at 2.75c. New buying has not been heavy the last few weeks, but there is no indication of any falling off of activity, and rolling mills have not been able to catch up in deliveries. One mill in the immediate district is asking 4.25c for shipment within six weeks or two months, and considerable tonnage has been sold at that figure.

New Ship Yard

Will Be Built on Very Extensive Scale by the Sun Co.

Another important addition to the rapidly-expanding ship building industry along the Delaware river, the Clyde of the United States, which will represent the largest new yard added to the ocean-going capacity of the country in a number of years, is to be established at Chester, Pa., by the Sun Co., a leading independent oil company.

Contracts have been placed for the erection of a complete new ship building plant costing several million dollars, which will be second in size only to the New York Ship Building Co., at Camden. The plans call for a yard of six ways each, 100 feet wide by 600 feet long, or with a capacity for building ocean craft up to 15,000 tons in size. The company proposes to standardize ship building operations in that it will specialize on a few approved designs of both tankships and cargo vessels, both for its own use and for the merchant trade, thereby effecting the highest economies of operation. It is proposed as soon as the yard is built to construct 18 10,000-ton boats which are to be completed in about 30 months.

The Sun Co. has acquired the going plant of the Robert Wetherill & Co., Chester, Pa., manufacturer of boilers and engines, and will build its own engines. A new corporation now is being formed to handle the ship building proposition. The Sun Co. is a New Jersey corporation, with a capitalization of $9,600,000. It is both a producer and a refiner of oil and has a large refinery at Marcus Hook, Pa., near which the new ship yard will be located. J. H. Pew is president; J. N. Pew Jr., vice president, and Frank Cross, secretary and treasurer. The Belmont Iron Works will furnish the 6,000 to 9,000 tons of structural steel for the new plant. Bids have been taken on 15 to 20 15-ton cranes and also have been asked for six large capacity cranes of the revolving ship building type for fitting out the yard. The machinery and other equipment are to be bought later.

(For complete prices see page 950.)

Domestic Ferro

Is Relieving the Stringency for Forward Delivery

New York, April 25.—Several good-sized inquiries for ferro-manganese and spiegeleisen for forward delivery are in the market, but the general volume of trading continues more limited and buyers do not seem so pressed to act on nearby requirements. An inquiry for 1,000 to 2,000 tons of ferro-manganese for first half is out from the Chicago district and a sizeable tonnage of spiegeleisen for next year also is being figured. Domestic-made ferro-manganese, from new operations, now is appearing in the market and is helping to relieve some of the present stringency, although such metal now being offered is for forward delivery as the nearby output of furnaces recently starting or about to be blown in is understood to have been well taken up by former sales. Some domestic ferro-manganese for third quarter now is being offered and sold at $225, at the furnace. There have been light sales of English ferro-manganese for May and June at $300, seaboard. English ferro-manganese for fourth quarter is offered at $200, seaboard, and for first half of next year, $175, seaboard. There has been little new selling for these positions. Prompt ferro-manganese still is held by sellers at $400 to $450, seaboard, with fair offerings, but it is to be noted that there are very few sales at present. Ground ferro-manganese is quoted at 20 cents per pound, at the grinding plant.

Domestic spiegeleisen prices for last half remain at $60 to $65, furnace, for 20 per cent with earlier deliveries commanding premiums. Offerings for early delivery are very limited.

Bessemer Ferro-Silicon Advanced

Pittsburgh, April 25.—Lower grades of bessemer ferro-silicon last week were advanced $2 a ton to $32, furnace, for 9 to 10 per cent material. Ohio furnaces are virtually out of the market, most of them being unable to assume additional obligations for delivery this year. Demand for 80 per cent ferro-manganese is heavy, but no new buying is reported in the immediate district. Fifty per cent ferro-silicon is commanding premium prices.

Shapes for New Plants

Industrial Buildings in Last Call for Considerable Tonnage—
Some Structures Postponed on Account of High Prices

New York, April 25.—A surprising amount of new construction in this district is coming out in the face of the extraordinary steel prices. Not less than 15 loft and apartment propositions in this city calling for about 15,000 tons of steel, are at an active stage. Any work that comes out for figures now is reasonably assured of going ahead. In addition to three large hotel projects now maturing, it is announced that Statler interests will erect a huge holstery here. Some buyers, in order to expedite their work, are placing the first one or two tiers of a job at store prices. On a new building calling for mill material, fabricators are not able to begin erection under three months.

Industrial Plants Take Tonnage

Philadelphia, April 24. — Industrial plant undertakings have brought from 10,000 to 15,000 tons of new work before eastern Pennsylvania shapemakers, and have been the most prominent development. One of these, requiring 6,000 to 9,000 tons for a new ship yard along the Delaware river for Sun Co. interests, has been closed and eastern Pennsylvania mills will supply the plain material. This is one of the large projects which have been referred to as being under quiet consideration. Further mill extensions at Coatesville call for 3,500 tons. The Philadelphia Electric Co. still is reported to be maturing plans for extensions which will require a large tonnage. Eastern Pennsylvania shapemakers find that their obligations still increase over their shipments and some of them are endeavoring not to sell much additional, but are obliged to take on new orders here and there. One maker has specifications on his books covering four months' output and has made some third quarter contracts at 3c, Pittsburgh, or 3.159c, Philadelphia. The minimum of the eastern market remains 2.50c, Pittsburgh.

Structural Shapes Firm

Pittsburgh, April 25.—Prevailing high prices of structural material tend to reduce building operations to a minimum, but fabricating shops in the Greater Pittsburgh district have taken enough tonnage to keep plants operating at maximum capacity for three or four months hence. Strength displayed by the market is reflected in a tangible manner by bids recently opened by the Pittsburgh board of education for structural steel for the new Westinghouse high school in the Homewood district. The contract, involving 1,426 tons, tentatively has been awarded to the American Bridge Co., which bid $120,550 for the fabricated material, equivalent to $84.50 a ton. Eighteen months ago, this material would have been available at considerably less than $50 a ton.

Structural shapes are being held at 2.50c for delivery at the convenience of the mill, but from $5 to $10 a ton above that figure is being obtained for near-by shipment. Fabricators are interested in the erection of a large department store building at Toledo, involving 3,000 tons, but it may be some time before owners of the proposed structure award contracts.

Hotel Plans Changed

Cleveland, April 25.—An interesting development showing the tendency to dispense with the use of as much steel as possible on account of the high prices prevailing is the decision to use concrete construction in the building of the new Hotel Winton, on Prospect avenue, by J. L. Free and associates. Several weeks ago it was announced that the contract for 2,500 tons of steel had been awarded to the American Bridge Co., but it was decided later to revise the plans and to make the building 125 feet high, requiring about 1,500 tons of reinforcing bars and a very small tonnage of structural steel.

The general contract for the new Boody House, Toledo, requiring 5,500 tons of steel, will be awarded April 28.

Cleveland's New Hall

The voters of Cleveland Tuesday voted for the issuing of $2,500,000 in bonds for the erection of a convention hall to seat about 15,000 people. Mayor Davis announces that he expects that actual work will begin within 60 days, but steel companies state that it will probably be impossible to obtain the steel in less than four months. No estimate as to the amount of steel to be required has yet been made. The cost per ton erected will probably be about $85, compared with about $40 a year ago.

Structurals Are Higher

Chicago, April 25.—An advance of $1 per ton has been made in the price of structural shapes, bringing the quotation to 2.69c, Chicago mill. This seems likely to intensify the present situation where the construction of buildings for investment is being turned from steel frame to other material, reinforced concrete or mill construction.

Projects closed during the past week show that nothing except railroad, industrial and mining structures and bridges are being let at present. Numerous instances are known of reinforced concrete being adopted on account of present high prices and remote delivery of structural steel.

(For complete prices see page 950.)

CONTRACTS AWARDED.

Illinois Steel Co., extension to main duplexing building, South Chicago, 1,700 tons, to American Bridge Co.

Humboldt county, Cal., bridge over Eel river near Scotia, Cal., 492 tons, to American Bridge Co.

Garfield Smelting Co., reconstruction of converter flue, Garfield, Utah, 437 tons, to Minneapolis Steel & Machinery Co.

Missouri Pacific Railroad Co., various bridges, 432 tons, to American Bridge Co.

City of Chicago, Central avenue pumping station, 330 tons, to Chicago Bridge & Iron Co.

Missouri Pacific Railroad Co., three 90-foot turntables, 234 tons, to American Bridge Co.

St. Joseph Lead Co., extension to sintering plant, Herculaneum, Mo., 216 tons, to Wisconsin Bridge & Iron Co.

Shipyard for the Sun Co., Marcus hook, Pa., 6,000 tons, to the Belmont Iron Works. Will probably be increased later to about 9,000 tons.

Building for the Girard estate to be occupied by Snellenberg store, Eleventh street, Philadelphia, 600 tons, of column cores, general contract to Wm. Steele Sons Co.

Coal pockets for the Baltimore & Ohio railroad near Baltimore, 600 tons, to the Hedden Iron Construction Co.

Building for the Waclark Wire Co., Bayway, N. J., 400 tons, to Milliken Bros., Inc.

Addition to the plant of the National Sugar Refining Co., Brooklyn, 600 tons, to the Hedden Iron Construction Co.

United States Custom House, Bloomington, N. C., 400 tons, to the Eastern Steel Co.

Piers for the city of New York at Fifty-sixth and Fifty-seventh streets and the Hudson river, 3,000 tons, Pennsylvania Steel Co. ow bidder **and expected to receive** award.

Hotel Statler, St. Louis, taking 4,000 tons to American Bridge Co.

Westinghouse high school, Pittsburgh, 1,426 tons, tentatively awarded to the American Bridge Co.

CONTRACTS PENDING.

Department store building for LaSalle & Koch, Toledo, 3,000 tons.

Mill buildings for Brier Hill Steel Co., Youngstown, O., 3,000 to 4,000 tons, bids being taken.

Car shops for the Michigan Central railroad at Detroit and Jackson junction, Mich., 1,000 to 2,000 tons, bids being taken.

Extension to the Kuhlman Car Co., Cleveland, 400 tons, bids being taken, Westinghouse, Church, Kerr & Co., New York, engineers in charge.

High school, Carbondale, Pa., 200 tons, bids being taken.

Theater, New Haven, Conn., 600 tons, bids being taken.

Two bridges over the Mystic river for the

City of Boston, and the Boston Elevated Co., 1,700 tons, bids taken.

St. Thomas School, Brooklyn, 300 tons, bids being taken.

Bridge work for Pennsylvania railroad, 200 tons, bids being taken.

Extensions to rolling mills of Worth Bros. Co., Coatesville, Pa., 3,500 tons, bids being taken.

High school, Portland, Me., 850 tons, bids being taken.

Passenger station at Poughkeepsie, N. Y., for the New York Central railroad, 600 tons, bids being taken.

Office building at New Haven for the Southern New England Telephone Co., 500 tons, bids being taken.

Highway bridge for the State of New York over Arondout creek near Kingston, N. Y., 1,000 tons, bids rejected and will be readvertised.

Bridge for the Baltimore & Ohio railroad in the Louisville district, 200 tons, bids being taken.

Building for the Geographic Society, 155th street and Broadway, New York City, 1,000 tons, bids being taken.

Dreicer loft building, Fifty-seventh street and Fifth avenue, New York City, 900 tons, bids being taken.

Scrap is Dull

In Leading Centers—Some Being Imported From Cuba

Pittsburgh, April 25.—The iron and steel scrap market continues dull and inactive. None of the larger mills has figured in the market for several weeks. Dealers have been able to pick up heavy melting steel at as low as $17.50, but it is not believed that a consumer could purchase a heavy tonnage at less than $18.25, delivered. Other grades of old material are selling at about 25 cents a ton less than prices prevailing a week ago.

Chicago Scrap Easier

Chicago, April 25.—Conditions in the scrap iron and steel market in Chicago are distinctly softer and comparatively little tonnage is moving. Buyers are not taking additional material and brokers seem anxious to dispose of their holdings.

Prices have receded somewhat from recent levels and many items are 25 cents to 50 cents lower than a fortnight ago.

Railroads continue to market their accumulations and in the aggregate a heavy tonnage is coming into the market from this source. Lists now current are as follows: Grand Trunk, 720 tons; Minneapolis, St. Paul & Sault Ste. Marie, 360 tons; Chicago & Eastern Illinois, 545 tons; Chicago, Burlington & Quincy, 3,000 tons; Chicago, Milwaukee & St. Paul, 3,600 tons; Rock Island & Pacific, 6,400 tons.

Cleveland Market Unsettled

Cleveland, April 25.—Business is dull in the Cleveland scrap market. Mills are not countenancing any buying whatsoever even at figures which would have caused them to buy heavily 30 days ago. The movement of material which has been held up on account of weather conditions is becoming heavier and it is believed that the present conditions will obtain for perhaps another month. Such activity as is being expressed is entirely between dealers. There has been a slight downward revision of prices in several grades as shown in price tables on page 950, this issue.

Wrought Scrap Active

Buffalo, April 25.—The only item in the scrap list that has developed a good demand in the past week has been wrought scrap. In the other lines the activity has been light. Consumers for the most part are holding off, except where they are able to secure concession prices. The dealers on the other hand are keeping the schedules to the level previously quoted, feeling that prices are due to advance rather than to decline.

Very Little Activity

New York, April 25.—Difficulty to make sales because of the tied-up position of the plants of many consumers, resulting from recent heavy shipments, has caused the old material market to be slowed up considerably and further price softness is to be noted. At Coatesville, fresh embargoes have been declared. While there is very little buying interest at the moment, there also is not much effort to sell, because of the recognized troubles surrounding shipments.

Philadelphia Market Weakens

Philadelphia, April 24.—Heavy shipments against old orders taxing the facilities of consumers to handle them and liberal offerings for sale, continue to weaken the old material market in this territory.

It is noted that prices have dropped of grades during the past week. Consumers are willing to buy for forward deliveries on which sellers do not wish to commit themselves, but they want little prompt material. The general activity of the iron and steel trade is bringing out offerings from distant points which under lower prices would not be offered or marketed here.

It is likewise interesting to note that scrap from Havana and Gulf points now is finding its way to this market. Buyers of heavy melting steel have been able to pick up odd lots under $18, delivered eastern Pennsylvania, and the larger users now have dropped their offers from $18 to $17.50, delivered.

Lower at Cincinnati

Cincinnati, April 25.—The scrap market continues quiet, and prices are weakening. A general decline from 25 to 50 cents a ton has taken place on all grades carried by local dealers. Heavy melting scrap is now quoted at from $13.75 to $14.25 per gross ton. Rolling mills are not even in the market for small tonnages, and jobbing foundries are taking very light requirements from time to time.

(For complete prices see page 950.)

Not Many Buying

St. Louis, April 25.—The iron and steel scrap market here shows neither strength nor activity except in a few specialties such as iron and steel axles, arch bars and locomotive tires. Most large consumers of melting steel still are out of the market. However, at the rate material is being consumed by the mills, it is expected buying of heavy steel will become a necessity within a short time. The relaying rail branch of the market is active and prices have advanced since the leading steel rail mills of the country announced an advance of about $5 a ton on new rails. The railroad offerings before the market this week include 3,000 tons by the Chicago, Burlington & Quincy railroad; 1,350 tons by the Terminal Railroad Association; 500 tons by the Lake Erie & Western railroad; and 100 tons by the Southern Pacific railroad.

Some Advances

Birmingham, Ala., April 25.—There has been much recent activity in steel and wrought scrap, while a tendency to soften has appeared in No. 1 cast owing to the quantity that has been turned on the market. Wrought especially has shown a great deal of strength and is disposed of by dealers as soon as acquired. There are no longer any large stocks on hand, most of the yards having done a large business in the past several weeks. Old car wheels advanced around $2 per ton to $12.50 to $13. Old steel axles are marketable at $19 when they can be secured in carload lots. Western foundries are in the market for considerable scrap from southern yards. The market is firm at the recently advanced figures with the exception of No. 1 cast.

Italy Wants Wire

New York, April 25.—A new inquiry for 1,000 tons of wire rods and 1,000 tons of barbed wire for delivery to Italy, has been cabled to this country.

The Chicago Eye Shield Co., Robert Malcolm president, has removed from South Clinton street to its new plant at 2300 Warren avenue, Chicago.

Eager Buyers of Bars

Willing to Pay Almost Any Price to Get Desired Material —Lake Mill Has Been an Active Seller

Philadelphia, April 24. — Buyers of large rounds are going to almost any length to obtain mill accommodation for this year's delivery. As an illustration, one buyer recently made an offer to a large Ohio producer of 3.75c, mill, for the first option up to about 15,000 tons of any steel not specified for by other purchasers under their contracts and agreed to take the material in billet form. The maker previously had advised this buyer that all its output of large rounds had been taken up by the contracts on hand. There has been considerable buying of shell bar crops in this district at about $38 to $39, delivered. One lake mill has been an active seller and has recently disposed of 15,000 to 20,000 tons of this material of which a part came to eastern Pennsylvania. Makers in the Youngstown district have sold bar crops up to $45, mill. The situation in soft steel bars is unchanged and there is very little effort or willingness to sell by makers. Odd sales are being made at 2.75c to 3c, Pittsburgh, with 2.50c the nominal minimum.

Heavy Tonnage Pending

New York, April 25.—Active negotiations for a large tonnage of shell bars for last half delivery are going forward in this territory. With several large new inquiries put out the past week by J. P. Morgan & Co. for France, fully 250,000 tons now are pending in the market for that country. Italy also has become an important buyer. The problem of the buyer remains to find the steel for the desired shipment, as makers have only limited quantities of unsold rounds before Jan. 1. Certain current reports that a large part of the shell steel output of this country to be made in 1917 already has been contracted for by foreign belligerents or domestic munition makers are not credited in general trade circles. Some of the works which have been among the heaviest sellers of munition stock during the past year or more have made no contracts whatever against their 1917 output and are not disposed to do so at present. Some odd tonnages for this year are being offered and small sales of 5,000-ton lots or so are noted. In some of these cases, as low as 3.25c, mill, has been done, which is exceptional. Most quotations run from 3.75c, mill, upward. The Wheeling Mold & Foundry Co. and the South Brooklyn Machine Co. have submitted to the United States government the lowest bids on the machining of 100,000 3-inch shells which are being forged at Bridgeport.

Continue Active

Pittsburgh, April 25. — Demand for steel bars for domestic consumption gradually is becoming heavier and mill managers express the belief that the domestic trade will readily absorb tonnages now entering into the manufacture of munitions. Nut, bolt and rivet makers, agricultural implement manufacturers and automobile interests are specifying briskly for bars, deliveries of which are deferred from three to nine months. Demand for bar iron also is heavy and prices are stiffening.

Chicago Bar Price Advance

Chicago, April 25.—An advance of $1.00 per ton has been made by leading makers of finished steel products, bringing the present mill quotation to 2.69c, Chicago mill, on bars. This price is quoted on material for delivery during 1917 on definite projects and the leading interest is also making the same figure on a small tonnage of prompt material which rolling schedules may make possible.

Anxiety of consumers to obtain the material is shown by the fact that one producer in this market has been selling short ends cropped from steel bars at 2.44c, Chicago mill. Usually this material has gone into scrap, but now is being taken to be converted into drop forgings. The steel is of prime quality but irregularity of length has made it difficult to handle under ordinary circumstances.

Bar Iron Steady

Chicago, April 25.—Makers of bar iron have sufficient tonnage on books to insure operations at least to July 1 and probably some distance beyond. Deliveries are apportioned so that some prompt material can be furnished during second quarter without difficulty.

For prompt delivery 2.35c, Chicago mill, is being quoted and for third quarter 2.50c, Chicago mill, is being obtained. Some tonnage has been booked for delivery for July 1, but this is not large.

Hoops and Bands

Pittsburgh, April 25.—Mills are selling hoops at 2.75c for delivery at the convenience of the manufacturer. Some makers are obtaining from $2 to $5 a ton above that price for nearby delivery. Specifications are coming out in heavy volume and new buying is rather active. Steel bands are quoted at 2.50c for future shipment.

Cold-Rolled Steel Shafting

Pittsburgh, April 25.—Manufacturers of cold-rolled steel shafting are not endeavoring to book additional tonnage, apparently not wanting to dispose of material at prevailing quotations. Some interests are asking 10 per cent off the list for carloads and less than carload tonnages are bringing above the list in many instances.

(*For complete prices see page* 950.)

Misfit Billets

Are Sold Without Trouble—Many Mills Booked Far Ahead

Philadelphia, April 24. — That users of billets still meet with difficulty in supplying their wants is shown in their willingness to absorb irregular material even at high prices. About 2,000 tons of misfit open hearth billets and blooms recently were disposed of in this district by an Ohio mill and some of it went at $55, mill. There is considerable buying in this territory of crop ends both of ingots or billets and of finished bars at high prices. Billets from the Chicago district are being offered here at about $54, delivered. Eastern Pennsylvania makers continue to quote open hearth re-rolling billets at $50 to $55, mill, and forging billets at $65 mill and upward.

Very High Prices

Pittsburgh, April 25.—Semi-finished steel products are commanding decidedly high figures in eastern Ohio and western Pennsylvania. Mills in a position to promise tonnages for prompt delivery are selling billets and sheet bars at $50, mill. Forging billets are commanding $85 a ton in isolated instances. Several plants rolling billets for war material have disposed of discards running high in manganese, at $55 a ton.

New Capacity

Youngstown, O., April 25.—Steel-making capacity in this district will be increased within a few days by the starting up of one of the new 90-ton open hearth furnaces of the Brier Hill Steel Co. Fires were started in this furnace last week. The company's second new furnace is now ready to fire and will be in operation within 10 days. This gives the Brier Hill company 10 furnaces. It is understood that the tonnage to be produced by these furnaces has already been discounted, sales being made against it some months ago.

Baker Protests

Against Abolishing Efficiency From Government Works

Washington, April 25.—The report sent last Saturday to Speaker Champ Clark of the house of representatives by Secretary of War Newton D. Baker expressing vigorous opposition to the Tavenner bill to eliminate the efficiency system from government establishments probably will not influence the action of the house committee on labor one way or another in its action on the bill, which is before it. The Baker report was referred to the house committee on military affairs and ordered to be printed as a public document. It consists of three closely typewritten pages, a liberal share of it showing actual results obtained under the Taylor system at the Watertown, Mass., arsenal, being along the line of those submitted recently before the committee on labor by Brig. Gen. William Crozier, chief of ordnance, war department, and published in *The Iron Trade Review*. The action of Mr. Baker in fighting the measure may give strength to the opposition in the house.

Speaking of the Tavenner bill, Secretary Baker in his report says: "I think that such legislation would be unwise," and at another point declares that "it would be a grave misfortune to the public service and to the employes of the government there (Watertown arsenal) engaged if any action were taken prejudicial to the system that is working so well."

Referring to the rider in the present army appropriations act doing away with time studies and bonuses, Mr. Baker says:

"The time study referred to may be defined as a method of ascertaining by careful observation and study in connection with a timing process the most advantageous manner in which a given piece of work can be done, and also the time in which it can be reasonably expected to be done by following this best manner. The premium is an extra cash compensation which is paid to a workman for accomplishing the work in this reasonable time, or for approaching the time within certain rather reasonable limits, the compensation being in addition to the regular wages of the workman, which are not disturbed, and depending in amount upon the degree to which he approaches the reasonable time which has been ascertained.

"The timepiece is used only in the study for a new job for the purpose of working it out properly and for assigning the proper time for its performance. It is not held over a man for the purpose of ascertaining whether he is working industriously, and its employment is of less and less frequency as information is accumulated which makes special study unnecessary. The premium is the workman's share of the economy which is effected by the system.

"The legislation which is being urged upon congress is advocated by organized labor, which is opposed to the system intended to be prohibited for the essential reason which is embodied in the charge that it is a speeding up system. I cannot understand this charge as having any other meaning than that the work required of the employes by the system is unduly severe." He asserts there is no truth in the charge as far as the government's

ALEXANDER C. BROWN

system at Watertown arsenal is concerned.

"There is a good deal of evidence the other way," Secretary Baker adds. "There is no complaint of overwork at the arsenal and no workman has been discharged because of failure to meet the requirements of the system. To prohibit the system of which the records show undoubted advantages both the government and to the employes, because of a charge unsupported by evidence, or even by an attempt at evidence—for there has been no effort to prove overwork at the Watertown arsenal—seems to me to be most unwise."

The Hussey-Binns Shovel Co., Pittsburgh, with works at Charleroi, Pa., has granted an advance in wages, effective May 1. Increases range from 5 to 10 per cent.

Zinc Smelter

Is Being Built by the Trumbull Steel Co., of Warren, O.

Official confirmation has been made of the plans of the Trumbull Steel Co., Warren, O., to build a zinc smelter. The announcement has unusual interest as it marks the first attempt of an independent galvanized sheet manufacturer to control the sources of its supply of spelter.

The new spelter is now being built and will begin operations about July 1. The operating company will be the Fort Smith Spelter Co., the plant being located at Fort Smith, Ark. The company has been incorporated under the laws of Ohio at $350,000. Its officers are D. W. Kerr, president, and H. S. Buck, vice president and general manager. Mr. Kerr is vice president of the Trumbull Steel Co., while Mr. Buck, who will be in active charge at Fort Smith, was formerly associated with the Warren company.

The plant will have four blocks, its capacity being about 1,000 tons of spelter a month. Zinc ore will be purchased in the open market. The Fort Smith company will also sell spelter. At first it is expected that the company will have about 500 tons of spelter for sale monthly.

New General Manager

The Brown Hoisting Machinery Co., Cleveland announces the appointment of its vice president, Alexander C. Brown, to the position of general manager, succeeding Richard B. Sheridan, who resigned recently to accept a position with the American International Corporation, New York. Mr. Brown, who is a grandson of the late Fayette Brown, who organized the company in 1880, and a son of the late Alexander E. Brown, who was vice president and general manager of the company for many years, was born in Cleveland, May 6, 1885. After graduating from Yale university with the degree of B. A. in 1907, he took a special course in mechanical engineering at Case School of Applied Science, Cleveland. In 1909, he became connected with the Brown Hoisting Machinery Co., and worked his way through the different departments until, in 1911, he was elected to the vice presidency.

Charles W. Green, 32 years old, sales manager of the Bollinger-Andrews Construction Co., Pittsburgh, died April 20 at Saranac Lake, N. Y., where he went about six months ago to recover his health.

Wonderful March Earnings

Made by the Steel Corporation—Usual Dividend is Declared by Directors

New York, April 25.—Another exhibit of remarkable earnings is contained in the report of the United States Steel Corporation for the first quarter of the current year, issued this afternoon, which shows net earnings of $60,713,624 for the three months. This, by far, is the largest earning of any quarter in the history of the Steel Corporation and it compares with $51,232,788 during the final quarter of 1915, or an increase of $9,480,836. The most striking feature of the report is the statement of earnings for March, when a total of $22,722,316 was netted, showing that present earnings are at the high rate of about $273,000,000 annually. The March earnings, alone, were more than was netted during the whole quarters of March 31, June 30, Sept. 30 and Dec. 31, of 1914, and during the first quarter of 1915.

The complete report for the quarter ended March 31 is as follows:

	Earn. before int. on subsid. bonds.	Int. on subsib. bonds.	Balance.
Jan., 1916	$19,600,374	$805,462	$18,794,912
Feb., 1916	19,992,804	796,408	19,196,396
Mar., 1916	23,517,542	795,226	22,722,316
	$63,110,720	$2,397,096	.....
Total earn. after exp. for oper., includ. ord. repairs and main. and subsid. bonded interest....			$60,713,624
Sink'g fund for sub. bonds, and deprec. and replacements...		$7,859,253	
Sinking funds U. S. Steel bonds		1,635,812	
			9,495,065
Net income			$51,218,559
Int. on U. S. Steel bonds		$5,444,687	
Prem. pay. on bonds redeemable		261,000	
			5,705,687
Balance			$45,512,872
Prfd. dividend		$6,304,919	
Common, dividend....		6,353,781	
			12,658,700
Surp. for quarter.....			$32,854,172

By way of comparison, the earnings during the final quarter of 1915 by months were: October, $16,563,854; November, $16,990,968; December, $17,677,966.

Though there was some late expectation that an extra dividend might be declared on the common stock, only the regular disbursements of 1¼ per cent on the common and of 1¾ per cent on the preferred, were made. The common dividend is payable June 29 to holders of record June 1 and the preferred May 29, to holders of record May 1. The directors made no announcement or statement bearing upon future policies with regard to extra dividends or to the disposition to be made of the rapidly-rising surplus. The surplus for the quarter just closed was $32,854,172.

All officers of the Steel Corporation were re-elected by the directors.

Late Rail Sales

New York, April 26. (By wire.)—New rail orders include 20,000 tons for the Chicago & Eastern Illinois, 24,000 additional for the Southern, 15,000 additional for the Chesapeake & Ohio, 5,000 additional for the Seaboard Air Line, 5,000 for the Chicago & Great Western and 35,000 to frog and switch manufacturers, the latter for delivery late this year. All these went to the Corporation. The Burlington order gives 20,000 to 25,000 to the Lackawanna Steel Co.

New Electric Installations

The Charleston Steel Co., Charleston, W. Va., recently incorporated with a capital of $400,000, has begun construction on a plant which will manufacture forging and alloy billets by the electric furnace process. Orders have been placed for two 8-ton Rennerfelt electric furnaces. The output will be marketed in billet form. Installations of Rennerfelt furnaces have also been made recently by the American Foundry & Machine Co., Salt Lake City, Utah, and by the Skagit Steel & Iron Co., Sedro-Wooley, Wash. The two Rennerfelt furnaces being installed by the Old Dominion Iron Works, Richmond, Va., are ready for operation.

Recalls Assault on Frick

Andrew Solsky, carpenter for the Carnegie Steel Co. building at Pittsburgh, who gained considerable fame by overpowering the anarchist Alexander Berkman when the latter attempted to assassinate H. C. Frick in the Homestead strike days in 1892, died at Pittsburgh several days ago. Mr. Solsky had been hanging a picture in the board room adjoining the priviate office of H. C. Frick. He stepped to the door of Mr. Frick's office to inquire how the latter liked the effect just as Berkman made his assault. The carpenter, hammer in hand, sprang upon the would-be assassin and beat him into submission before he could make any further attacks upon Mr. Frick, lying dangerously wounded.

Option Given

On Capital Stock of Iroquois Iron Co. Probably to Coke Corporation

Chicago, April 25.—Majority stockholders, controlling approximately $3,300,000 of the $5,000,000 capital stock of the Iroquois Iron Co., operating a blast furnace at South Chicago, have given an option on their holdings. The company has outstanding about $2,000,000 in bonds, notes, debentures, in addition to the stock. The option provides that minority stockholders may dispose of their holdings on the same basis as the majority, in case the option is exercised and the transfer effected. The right for minority holders extends beyond the date when the option expires, which is said to be July 1.

No official statement is made as to the interests behind the transfer, but rumors having the semblance of truth say that interests connected with the By-Product Coke Corporation are interested. A few months ago these interests took over control of the Federal furnace at South Chicago, and it appears possible that the two iron producing properties may be operated under one control.

Directors of the Iroquois Iron Co. are M. Cochrane Armour, its president; D. B. Meacham and D. B. Gamble, Cincinnati; Edwin S. Mills, Heman Gifford, Charles H. Schweppe, Geo. A. Tripp and C. A. Stillman, Chicago; and William A. Rogers, Buffalo.

The Iroquois plant contains four stacks built in 1890, 1900 and 1912. Three are now active, one being out for relining and will be returned to activity as soon as possible. One of the three active stacks is being operated by the Miami Products Co. in the production of ferro-manganese.

In case the option is exercised according to rumors as to the identity of those holding it, sale of iron from Iroquois furnace probably will transfer from the hands of Rogers, Brown & Co. to Pickands, Brown & Co., who already handle iron from Federal furnace, Northwestern furnace at Mayville, Wis., and Zenith furnace, Duluth.

Low Scrap Prices

Pittsburgh, April 26. (By wire.)—The old material market is dull and inactive and reflects further weakness. A consumer of heavy melting scrap has taken a large tonnage at $17.50, or 50 cents a ton below the previous minimum price.

Controling Piping and Segregation

THE RAPIDITY of solidification of steel in the ingot mold has an important influence on the character of the metal. In this article, an eminent authority analyzes the conditions of pouring, treating and cooling which produce undesirable steel and describes methods for lessening segregation and effacing piping

BY DR. HENRY M. HOWE

AXIAL cavities or pipe are formed in steel ingots, on account of the fact that during the latter part of the solidification, the central parts of the ingot are contracting more rapidly than the outer parts. The relative rates of contraction of the outer and inner parts, therefore, govern the the whole phenomenon. These rates of contraction represent roughly the corresponding rates of cooling, and it is by studying these rates of cooling that we can best understand the matter. When a mass of molten steel is poured into a cold metallic mold, its skin begins to cool very rapidly, owing to the escape of its heat into the mold walls; whereas the cooling of the interior is much slower, because the heat that escapes thence must pass chiefly through the still hot outer walls of the ingot. As soon as a continuous outer crust has formed on the top as well as on the sides, two parts may be recognized, the outer and *solid parts,* containing what we may call a *cave,* which is still filled with molten steel. During the early part of the solidification, in which the outer parts are cooling faster than the molten interior, the dimensions which they tend to give the cave are smaller than the volume of the metal which that cave has to contain, just as when a hot tire is shrunk on a wheel. Because the molten metal within the cave, like the wheel within the tire, is incompressible, it resists the natural contraction of its walls and in effect stretches them in the sense in which the wheel stretches the tire, preventing it, at every degree of temperature in the cooling, from contracting to the natural dimensions which it would have reached if unopposed.

This cooling of the outer parts, however, cannot continue indefinitely to be faster than that of the interior, because, both starting at the same temperature, say 1,500 degrees Cent., and cooling to the same temperature, it is evident that they must pass through the same temperature range, and towards the end of their cooling, when the center has sunk to 100 degrees Cent., the outer parts are but little cooler than the central ones. Hence because the outer parts cool faster than the inner ones at first, they must needs cool less rapidly than the latter at a later period, and at some moment the rate of cooling of the outer and of the central parts must be identical. We may call this the *neutral moment,* and the periods which precede and follow it the pre-neutral and the post-neutral ones, respectively. Owing to the fact that the contraction of the outer parts tends to be more rapid than that of the central ones during the entire pre-neutral period, the outer parts are being stretched by the resistance of the slower cooling central parts, but this rate of stretch decreases continuously till, at the neutral moment, it becomes zero. At this moment, as at every preceding one, the dimensions of the cave exactly fit those of the molten metal, because the molten metal, in resisting the pressure of the walls of the cave, has stretched them out to its own volume. But the excess of contraction of the interior of the ingot over that of the shell from the neutral moment on gives rise to a void which at every instant is equal to that excess. Where will this void lie? The top of this pipe represents the top of the molten at the neutral moment. If Fig. 3 represents a cube of molten steel in an iron mold losing heat equally in every direction, then the concentric squares F, F^1, F^2, etc., are *isotherms.* One specific isothern concerns us greatly, that of the freezing point, assuming for simplicity that the metal has a definite freezing point instead of a freezing range. This we may call the *tectotherm.* During the pre-neutral period the tectotherm coincides at every instant with the top, bottom and sides of the case, which are also those of the molten.

The cube F^2 of Fig. 3 represents the tectotherm and hence the outline of the cave at the neutral moment. Clearly the deficit of contraction of the interior compared with the exterior, a deficit which begins with the post-neutral period, or in other words the shortage of the

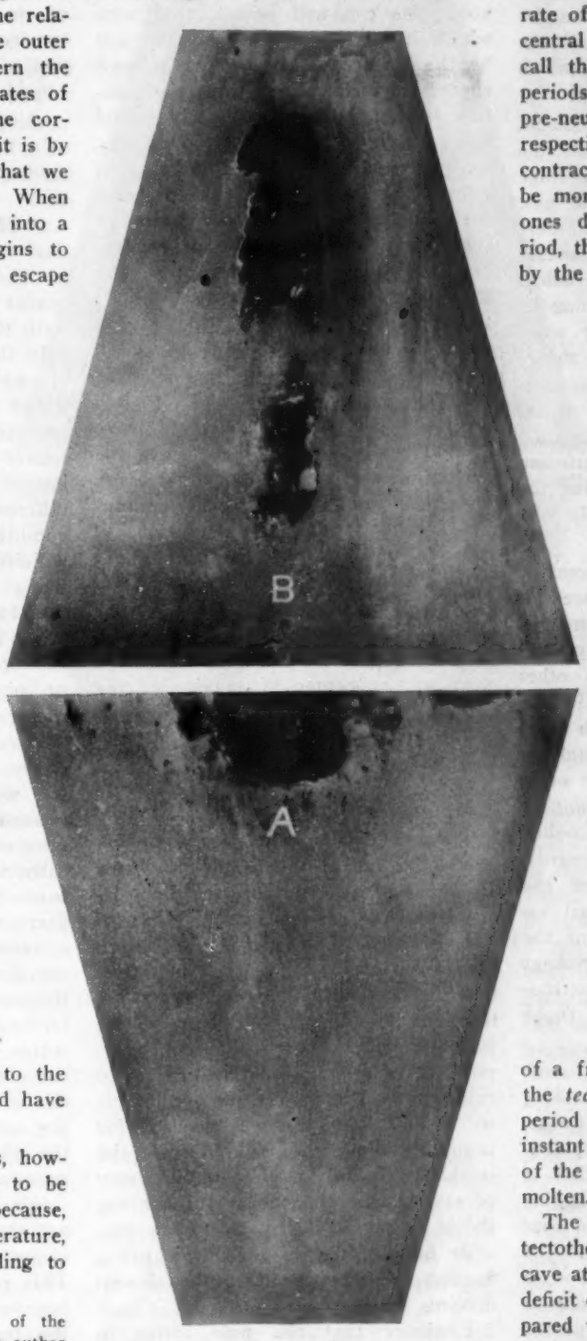


FIG. 1—PIPING AND SEGREGATION IN STEEL INGOT

A paper read at a recent meeting of the American Iron and Steel Institute. The author is emeritus professor of metallurgy, Columbia University, New York.

molten compared with the volume of the cave, will henceforth prevent the top of the molten from reaching quite to the top of the cave, with the result that, a few moments later, a thin flat void will exist, such as is shown just below the top of cube F^3. This void, which is the beginning of the pipe, will persist. The slight narrowing, due to the linear contraction of the solid metal from the freezing point down, need not here be considered. In order to show the void, I have to give it a visible thickness, such as it will reach shortly after the post-neutral period begins. But its very incipiency occurs at the neutral moment, and by parity of reasoning, its incipient width, that is, its width at its very top, is that of the top of the tectotherm at the neutral moment, which is also that of the molten metal.

That the inner part of the walls should be contracting more rapidly than the outer part at the relatively early stage in the solidification at which the pipe begins forming may surprise us. Perhaps an easier way of understanding this is to conceive the thermal gradient as extremely steep at the beginning of solidification, and as nearly flat when cooling is nearly complete, and thence to infer that its steepness decreases continuously from the beginning, or at least from very early in the solidification to the end of cooling. But a flattening of the thermal gradient means that the outer parts are cooling more slowly than the inner.

A more accurate but more complex picture is that, because they are integrally united, the various concentric layers which make up the already solid walls, are striving against each other because of their different rates of cooling. This struggle will go on with varying resultants, but with the general result that the progressively firmer outer parts resist to ever better advantage the tendency of the faster cooling inner parts to drag them inwards. This result in time brings on the neutral moment when the actual inward travel of the inner face of the walls ceases to exceed the shrinkage of the molten caused by the continuous transfer of its particles to those solid walls.

The special properties of iron, such as its marked expansion in cooling through the transformation range, offer themselves as tempting explanations of why the pipe forms, that is why the volume of the cave begins at the neutral moment to exceed that of the molten, thus giving rise to the void or pipe. But this temptation is to be resisted, not so much because this expansion is a wave which passes through from crust to center, and hence explains that exceeding only lamely, as because the pipe forms in the solidification of so many different kinds of substances, which undergo no corresponding transformation after solidification.

Width of Pipe and Molten Correspond

The width of the pipe at every level is the width of the top of the molten when at that level. At the neutral moment the width of the top and of the bottom of the void are practically the same. As freezing proceeds, the continuing deficit of contraction of the interior compared with the exterior leads to a continuous increase in the volume of the void. Its top will remain that with which it started, and its bottom will be the surface of the molten at each successive instant. To trace the position of this bottom accurately would carry us too far, but to fix our ideas, we may imagine that the increase of volume of the void just keeps pace with the thickening of the walls, so that when, in the course of solidification, the walls and bottom of the cave have become those of cube F^3, the top of the molten will have sunk so as to coincide with the top of F^3, and that the same holds true of cube F^4. The width of the pipe at each level will be the width of the cave at that level at the moment when the surface of the molten is at that level, and hence under our present assumptions, will at stages F^3 and F^4 coincide with the width of cubes F^3 and F^4. Hence after solidification is complete, the outline of the pipe will be represented by the lines bcde, b'c'd'e, an inverted cone with its apex at the center of gravity of the whole, and its base where the top of the tectotherm was at the neutral moment.

Pipe Varies With Isotherms

Though the foregoing assumptions are not accurate, they suffice to show us that the position of the pipe depends on the successive positions of the isotherms, of which the tectotherm is but one. Hence the inference that to raise the isotherms raises the pipe. In particular, to raise the position which the tectotherm occupies at the end of solidification, is to raise the bottom of the pipe, and thus to reduce the discard needed for removing the pipe. But to raise the isotherms is only a philosophical way of saying that the cooling of the top should be made to lay as far as possible behind that of the lower parts, or that the pipe forms in the slowest cooling part.

Evidence that the pipe forms in the slowest cooling part is shown, as regards the vertical position of the pipe by castings *A* and *B*, in Figs. 1 and 2, which really form parts of one and the same casting, poured simultaneously from the same ladle, save that *A* naturally filled before *B*. The broad ends or bases of these two pyramids cooled much more slowly than their apices, not only because they were thicker, but also because they kept each other warm, whereas the cooling of the apices was hastened by contact with the cold iron walls of the mold, especially because these walls thickened from base to apex of each pyramid. This slower cooling of the base than of the apex has set each pipe near the base, of its pyramid, above the center of gravity of *A* and reaching to below that of *B*.

That the pipe forms in the slowest cooling part not only vertically but also horizontally is illustrated by the casting shown in Fig. 3, cast in a mold of which the right-hand side was of iron and the left-hand one of clay. This, because it accepts heat so slowly from the metal, in effect moves the isotherms to the left, and with them the pipe.

In the ideal case of Fig. 3, the pipe stretches up from the center of gravity of the ingot. This same principle explains in part why the pipe is nearer the base or large end in casting *A* than in casting *B*. But this difference is exaggerated by another condition. At every stage during the solidification, the walls of the cave, being barely at the freezing point, are barely solid and therefore sag down by gravity, or to look at it from the opposite point of view, the void or pipe swims slowly upwards by gravity through the viscous mass. In this sagging of the metal and lifting of the pipe, not only the very face of the walls but also the metal for a considerable distance back from them take part. This sagging aids powerfully in raising the position of the lower end of the pipe, and thus in decreasing the needed discard. Clearly a retardation of the cooling of the top, however brought about, facilitates this sagging. Beyond this, mere retarding of the solidification as a whole, whether through increase in the cross section of the mass, through the use of poorly conducting clay or dry sand walls or otherwise, increases the time available for this sluggish movement.

We shall see that solidification is accompanied by an enrichment of the upper part of the molten in carbon. This means a lowering of the freezing point there, with the result that the tectotherm ceases to be strictly an isotherm, but corresponds to a lower temperature in the upper than

in the lower part of the ingot. This is as if at the moment when the lower part of the tectotherm, the outline of the molten, coincided with the lower part of cube F^3 of Fig. 3, its upper part coincided with the top of cube F^2. Because the carbon content of the upper part of the molten is greater than that of the lower part, the freezing of the upper part is occurring at a temperature lower than that of the lower part, that is along an isotherm nearer the outside of the ingot, and hence nearer the top.

This difference between the tectotherm and the isotherms, coupled with the sagging and swimming just explained, and the habitual open top, explain why even in narrow-topped ingots the pipe, instead of being chiefly below the mid-height of the ingot, is well above it. The influence of a wide top in raising the pipe has already been illustrated by castings *A* and *B*. The conditions are not so unfavorable to narrow-top castings in actual practice because here the narrow-topped ingot does not in addition have its apex chilled by the contact of the mold and its base warmed by that of a body of hot metal below. But for gravity and for the exposure of the top to warm air instead of to the cold stool, the pipe might be expected to be as much below the center of gravity in a narrow-topped ingot as it is above that of a wide-topped ingot. But in lifting the pipe, gravity moves it exclusively up and away from the center of gravity of a wide-topped ingot, whereas in a narrow-topped one part of this lifting effect of gravity is consumed in bringing the pipe from below up to the center of gravity, and only the residue is available for lifting the pipe above that center.

The massing of metal at the top of a wide-topped ingot clearly favors sagging and the resultant raising of the pipe.

Top heating, which in effect raises the isotherms by retarding the cooling there, may be brought about by means of a coke, gas, or other fire, by electric heating, or by pouring on molten slag. Hadfield's process for preventing the heating agent from carburizing the upper part of the steel by interposing a slag buffer is important. Remarkable results are rumored to have been reached by covering the top of the molten metal with graphite, which should carburize the metal there, lower its freezing point, and thus prolong the period during which it remains fluid enough to sag and feed the pipe.

Top insulation, which raises the isotherms by retarding the escape of heat from the top, may be effected by the use of clay or other non-conducting prolongations of the mold, which may be preheated as in crucible practice, thus adding top heating to top

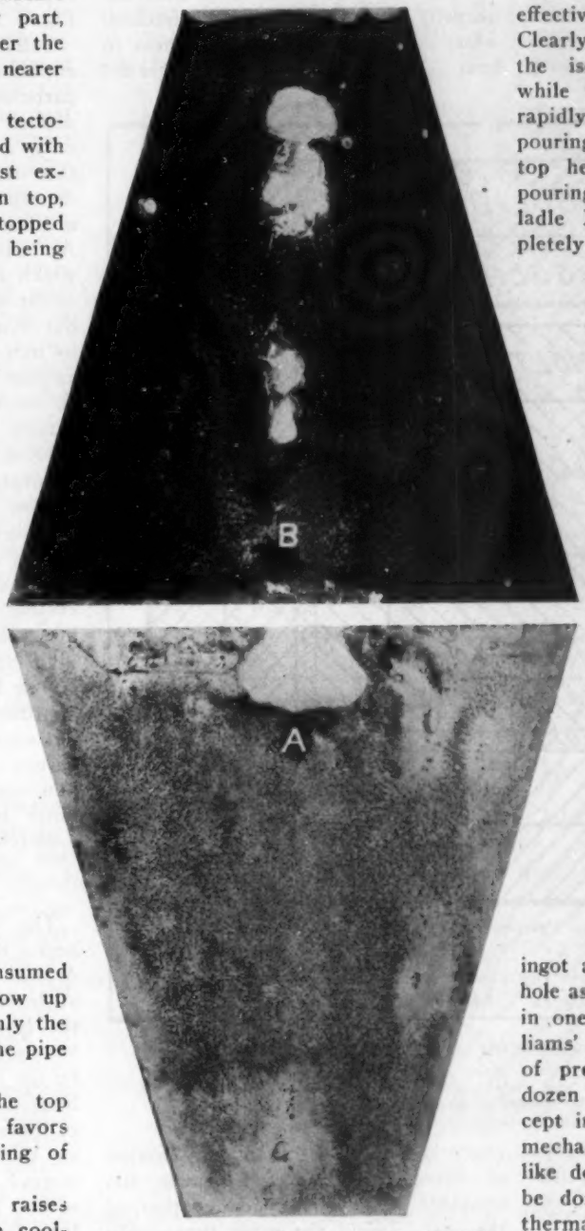


FIG. 2—SECTION OF STEEL INGOT SHOWING PIPE AND SEGREGATION

insulation, or by coke, clay, or other coverings, cold or hot. Indeed most of these steps do both. Gathmann's molds, thicker below than above, in a sense cause top insulation, in that they remove less heat from the top than from the bottom.

The common practice of either covering the upper surface of the ingot with sand or other insulating material or leaving it open to the air, is in effect a form of top insulation, for the escape of heat is less rapid into the sand or air than into the cold iron mold walls.

Top replenishment, by adding molten steel towards or after finishing the pouring of the ingot proper, helps directly to fill the pipe, and also gives top heating.

Slow pouring is a very cheap and effective mode of replenishment. Clearly, retarding the pouring raises the isotherms by heating the top while the lower part is losing heat rapidly into the mold walls. Slow pouring is thus in effect a kind of top heating. I have found that by pouring very slowly from a heated ladle I could efface the pipe completely under conditions which otherwise led to a very deep pipe.

Bottom pouring, for like reasons, tends to deepen the pipe, by adding fresh hot metal to the bottom of the ingot even after most of it has been poured and has started to transmit its heat into the mold walls. It thus lowers the isotherms and with them the pipe. Sink heads act through top replenishment, top heating, and in a sense through slow pouring. They feed down as fast, and only as fast as the pipe tends to form. The slower contraction of the outer than of the inner parts of the solid walls during the post-neutral period may be prevented or cured forcibly by mechanical compression after many different methods, by compressing the ingot lengthwise in Whitworth's way, with perhaps the maximum pressure requirement; or by driving the ingot as a tapered plug into a tapered hole as in Harmet's way; or by pressing in one of its flat sides in S. T. Williams' way, with perhaps the minimum of pressure; and in any one of a dozen other conceivable methods. Except in the case of very large ingots mechanical compression often seems like doing by brute force what could be done by finesse, by planning the thermal conditions. Compression generally has to be postponed till after the solidification has progressed far, when it has to overcome very great resistance from the already solid walls of the ingot.

The commonest method of all is to limit carefully the killing of the molten steel so that it will evolve gas rather late during solidification, and therefore cause blowholes which are deep enough not to oxidize. In effect these puff up the inner parts of the

already solid walls, and thus cancel their tendency to cause a pipe by contracting more slowly than the outer parts. This effect can be traced in Fig. 5, in which the abundance of the blowholes has reduced the pipe to its relatively small size. Not only the white vermicular spaces at the right but also most of the light gray ones there are blowholes, whereas the darker gray ones on the left are segregates, apparently blowholes into which segregate has been squeezed after their formation. The volume of

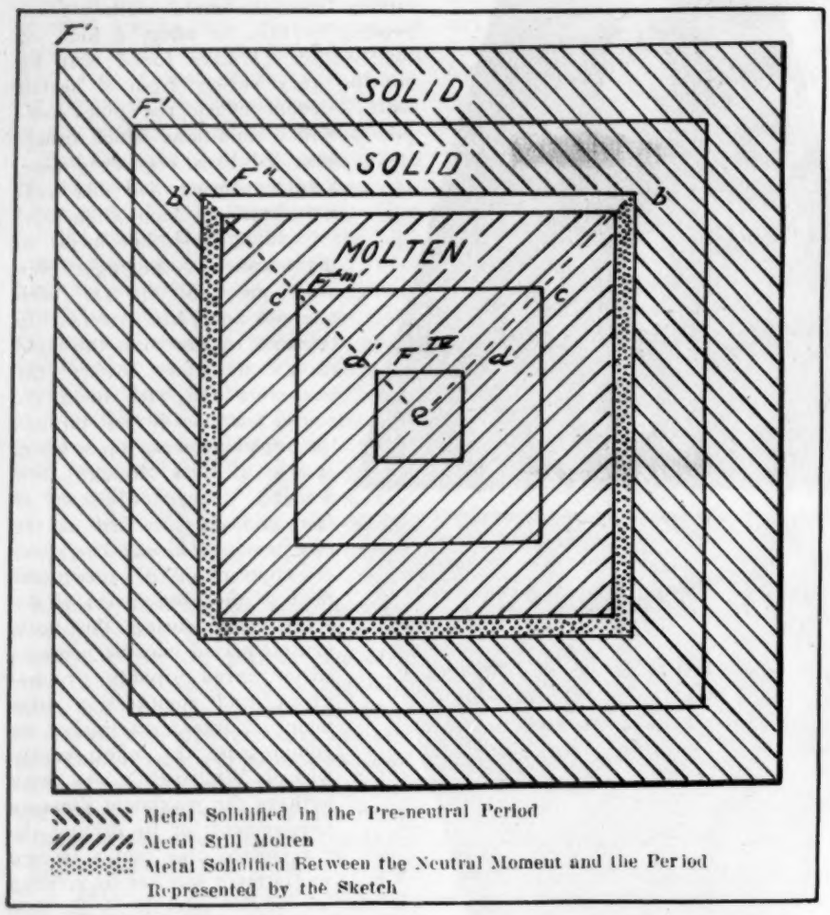


FIG. 3—VERTICAL SECTION THROUGH A SOLIDIFYING STEEL CUBE

The top of the pipe b'b corresponds to the upper surface of the molten at the neutral moment. With uniform heat escape and under certain ideal conditions, the bottom of the pipe should be at the center of gravity, but for sagging

the blowholes cannot be regulated closely, and hence it is usually restricted so that it is too small to close the pipe completely.

In general to prevent piping by creating blowholes seems the least intelligent though often much the creapest method. In the case of the higher carbon steels and the alloy steels it is hardly to be considered, because here the blowholes will not weld. We may question whether it is consistent with proper regard for the lives of travelers to tolerate this practice in making ingots for steel rails. Of the various deoxidizing additions for preventing blowholes, by removing the oxygen which otherwise would combine with the carbon present to form carbonic oxide gas, that would seem the best which, while deoxidizing the metal thoroughly, yields a fusible or rather a coalescing slag which will swim to the surface and escape. The composition of the slag must needs vary, for any one kind of addition, with the quantity of oxide to be removed, which in turn must vary from heat to heat. Direct experiments are needed urgently to show what combination of these additions will, under the probable range of oxygen content of the metal, yield the most thoroughly self-expelling slag. The thoroughness with which blowholes, and their result, segregation, have been suppressed in this or that heat by one or another deoxidizer is weak evidence. I have heard of no attempt to answer this question intelligently.

The formation of the pipe being due to a difference between the various layers as regards their rates of contraction, none could form if there were no such difference, and its volume and depth must clearly decrease as this difference decreases, being for instance much less when a wide ingot solidifies in a soaking pit than when a narrow one solidifies in a strong winter's wind. Rapid solidification increases the formation of blowholes, as is shown by the great excess of those in the left hand or chilled side over those on the right hand or slowly cooled side of the casting shown in Fig. 5.

Solidification is a process of differentiation. The carbon content of the particles of solid metal which first deposit on the sides of the mold is only a certain fixed percentage of that of the molten out of which they deposit. This percentage is fixed for a given carbon content of the molten. As this content varies, the ratio which it bears to the carbon content of the depositing layers varies slightly, but not to a degree that concerns us here. So with the phosphorus and sulphur. They may here be left out of account, because what is true of carbon is true of them. Because this process enriches the molten progressively, and because the carbon content of the solid particles deposited at any instant is proportional to that of the molten out of which they deposit, the carbon content of the successive solid layers as they deposit increases progressively from beginning to end of the solidification. Hence the successive positions of the tectotherm are recorded permanently by successive lines of nearly equal carbon content, or isocarbs, the carbon content being smallest at the outer crust and greatest at the last solidifying point.

Types of Solidification

The condition just described assumes that the successive layers which deposit are smooth and concentric, or at least co-axial with the mold, like the layers of an onion. But instead landlocking solidification may occur by the inshooting of pine tree growths from the sides. The interlacing boughs of these pine trees landlock the metal, so that the progressive enrichment, instead of being from the outer crust of the ingot as a whole to its axial last freezing point, is from surface to center of each one of these little pockets.

Even in this case there is some concentration of carbon from the outer to the last freezing parts of the ingot as a whole, but the concentration is much less than in the onion type, a large part of the carbon which in the onion type is crowded progressively to the last freezing axial point being lockel up locally in these little pockets. We may surmise that the columnar

outer part of the ingot has solidified pine treewise, and the granular inner part onionwise. When the pine tree type is replaced thus at the end of the columnar region by the onion type, the type of segregation changes with it from being local, little pools of molten concentrating their carbon into their own little centers, to being general, the mass as a whole henceforth concentrating its carbon towards its last freezing part in the axis of the ingot. This implies a sudden increase in the thoroughness with which the carbon is moved towards the last freezing part of the ingot as a whole and away from these layers now solidifying. Hence arises what is often called *negative segregation,* which means only that the impoverishment of these relatively early freezing layers is no longer interfered with by local retention of the carbon in little pine tree pockets, so that as we pass horizontally from the columnar region in the lower part of the ingot into the granular part, the carbon content decreases, and sometimes very considerably.

The landlocking type of solidification and segregation should yield greater homogeneousness, first because it lessens the axial enrichment, and second because its local variations in carbon cover such small distances that they are readily effaced, or at least greatly lessened, by diffusion aided by the kneading of rolling and forging.

Lessening Segregation

The most effective means of lessening segregation is quiet, probably because this leads to undercooling and hence to the pine tree land-locking type of solidification, as explained in the discussion of Mr. Kenney's paper on "The Commercial Production of Sound and Homogeneous Steel", read at the last meeting of the Institute. The boiling caused by the rise of part of the gas of which the remainder causes blowholes is the greatest disturber of quiet, and hence wildness is the greatest aggravator of segregation. In most cases the rational procedure is to quiet the steel completely so as to prevent blowholes, and thereby to lessen segregation, and in addition to prevent, in the ways sketched above, the pipe which the absence of blowholes tends to cause. The effect of quiet is illustrated by a comparison of the quiet steel of Fig. 2 with the wild steel of Fig. 5. Though each of the pyramids of Fig. 2 is about thrice as large as the prism of Fig. 5, the volume of the segregate in the latter seems larger than in the former. An examination of casting *A* of Fig. 2 shows its fine colonial dendritic structure, with little local segregates landlocked between the trunks and branches.

We have seen that at every stage during solidification the existing bottom of the void or pipe is the existing upper surface of the molten.

This is true also of the last stage of solidification, when the molten is reduced to its last drop. With the freezing of that last drop the bottom of the pipe becomes the bottom of that drop. Because that drop is the final product of the continuous process of enrichment, it is the richest spot of all. Hence the richest spot lies at the bottom of the pipe, for instance just below that of casting *A* of Fig. 2.

This inference is supported by the excentricity of the segregate in the casting shown in Fig. 3, its following the pipe to the slower cooling side of the ingot.

The position of the segregate with regard to the pipe bottom may be modified by various minor conditions. After solidification is complete the sides of the pipe may sag down enough to cover the richest spot with a considerable layer, especially if the cooling is very slow and the opportunity for sagging is therefore long.

Because the position of the segregate is affected less than that of the bottom of the pipe by the swimming of the void and by sagging and tearing after the end of solidification, it follows the isotherms even more docilely than the pipe does. Thus in casting *B* of Fig. 2, while there is indeed segregate just below both the pipe bodies, yet there are other masses of it even lower down than the bottom of the lower pipe. Part of the segregate indeed forms a layer stretching across most of the lower edge of this casting. We may surmise that this was the very last part of this casting to solidify, and that the higher position of the pipe is due to its swimming upwards through the metal. The position of the segregate is often thought to be due to the lightness of the segregating

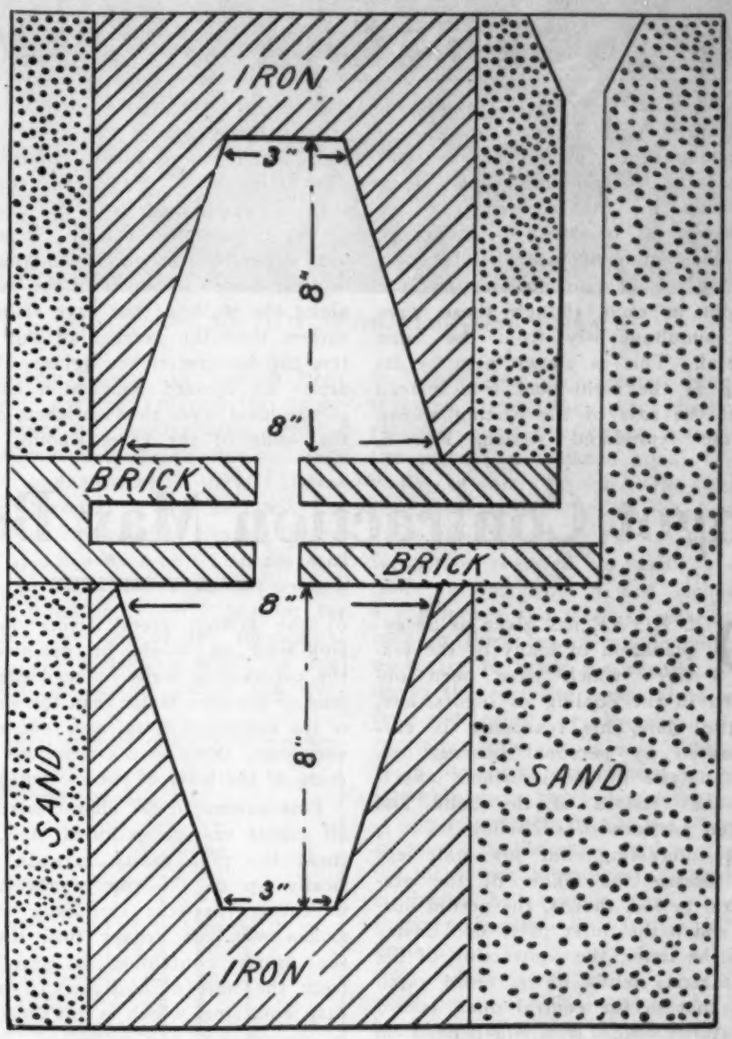


FIG. 4—METHOD OF CASTING STEEL INGOTS

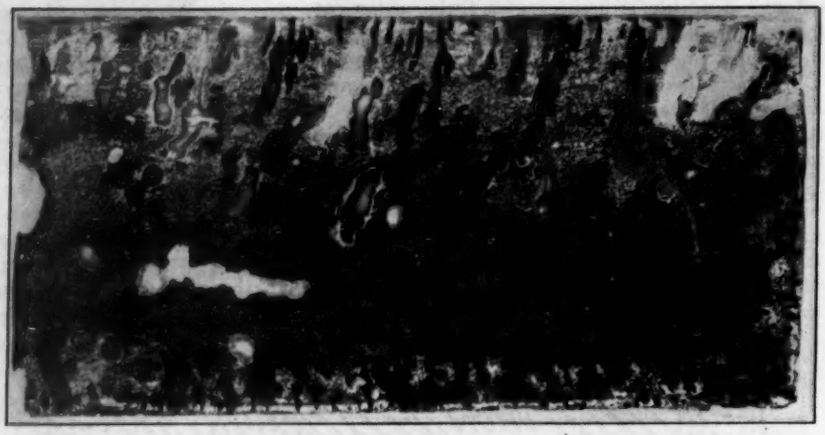


FIG. 5—SEGREGATION IN WILD STEEL

elements, carbon, phosphorus and sulphur. But its position is governed primarily by the contours of the isotherms, as is shown by its being near the bottom of casting *B* but near the top of *A*, just below the pipe bottom in each, though these were cast simultaneously from the same ladleful. This is shown also by its being at the right-hand side instead of at the axis of the casting shown in the reproduced section, Fig. 5. But lightness probably contributes. The splitting-up of the layer in the act of solidifying into a fraction poorer in carbon which solidifies and one richer in carbon which remains molten, makes the layer of the molten along the walls of the cave richer in carbon than the average of the molten, and because richer lighter. Hence arises an upward convection current of the local layer thus enriched, along the walls of the cave, leading to a certain degree of stratification, the lighter and richer parts yielding readily to this upward convection, but offering a moderate resistance to any corresponding downward convection.

Any evolution of gas in the molten metal occurs at these same walls, and the rise of this gas in small amounts helps this upward convection. It may be for this reason that the upward concentration of the segregate is so marked in the casting of Fig. 5, which formed many blow-holes, whereas those of Figs. 1 and 2 formed none.

Littoral convection increases upper-axial segregation in an additional way. Because the carbon content of the solid particles which deposit on the sides of the cave increases with that of the molten out of which they deposit, this lifting of the enriched shore-layers of the molten, in that it correspondingly lessens the carbon content of the molten out of which the next succeeding solid particles will deposit on the lower part of the walls of the cave, lessens their carbon content, too, while enriching correspondingly those next to deposit on the upper part of those walls.

Ingot Contraction May Be Homogeneous

BY E F. KENNEY

DR. HOWE has given us an explanation of many of the features which have been observed in the cooling of ingots, and, in the main, his reasoning is corroborated by personal observations. His analysis of the influences affecting the relation of the solid and molten portions of a cooling ingot is most interesting, but his statement that during the whole of the preneutral period, that is, the period during which the outer parts cool faster than the inner, the contraction of the outer parts tends to be more rapid than that of the central ones, is not necessarily true. It would depend on the relative coefficients of contraction of the two parts. The outside walls might be cooling much faster than the molten interior, but if the coefficient of contraction of the molten metal were sufficiently great, its shrinkage might be much greater than the contraction of what Dr. Howe has called the cave. That this is what actually occurs is indicated by observations on sink-head ingots of thoroughly deoxidized steel, which have been kept open on the top. Instead of the molten metal rising in the sink-head, as would be produced if the contracting walls reduced the volume of the cave faster than the volume of the contained metal was reduced by shrinkage, there is a continuous lowering of the level of the molten metal.

This seems to be characteristic of all ingots cast from killed steel. In these the pipe cavity extends practically up to the top of the ingot, indicating that the shrinkage of the molten metal is greater than that of the cavity containing it practically from the time of casting. In ingots cast from steel which is not thoroughly deoxidized, and in which consequently there is an evolution of gas, forming blowholes, I have observed a condition similar to that described by Dr. Howe, and a considerable zone of solid steel is found between the top of the ingot and the top of the pipe cavity. In these cases, however, the metal continues to fill the cavity, not because the cavity is being reduced by a shrinkage of the walls, but because the volume of the molten metal is being increased by the formation of blow holes within it.

There is just one other point on which I am not convinced by Dr. Howe's reasoning. This concerns the effect on segregation of the upward currents caused by the gas bubbles in a rising steel.

In my judgment this is a very important factor in the intensifying and localizing of segregation. When lively steel is poured into an ingot mold, there is a very rapid evolution of gas, which causes an intense boiling in the mold. There can be little doubt that this violent boiling does keep the metal thoroughly mixed; but as the steel cools, the amount of gas evolved gets very much less. A few bubbles rise in the steel, generally along the edge of the freezing metal, bringing up with them metal which is so near its temperature of solidification, that it can be seen to freeze almost immediately after being ejected from the little craters which are kept open in the top of the ingot by the escaping gas. It is at this stage that the segregated metal is brought to the top of the ingot, and there is not sufficient downward current to overcome the tendency of the lighter, more segregated metal to remain at the top after being brought up. The marked segregation found in the zone of the deep-seated blowholes when they are present in considerable numbers. corroborates this theory.

A discussion of Dr. Henry M. Howe's paper on "Controling Piping and Segregation." Mr. Kenney is associated with the Cambria Steel Co., Johnstown, Pa.

Installs Large Reheating Furnace

A continuous oil heating furnace of unusual size and design has been installed recently by the American Shop Equipment Co., Chicago, at the plant of the Bates Expanded Steel Truss Co., East Chicago, Ind. The furnace is 40 feet long over all and takes up to 35 feet in length. It is said to be the longest reheating furnace in use in this country. A feature that makes for efficiency in heating is the fact that the H-sections are fed into the heating chamber continuously. They are supported on cross girders, thus forming a solid horizontal wall, exposed to heat on both sides. The interior construction of the furnace is such that the heat is deflected by this layer of sections as by a baffle wall, the webs of the sections being heated uniformly on both sides by equal exposure. A temperature of 1,500 degrees Fahr. is obtained in about 30 minutes. Heat is supplied by eight crude oil burners located at the lower rear portion, a large combustion chamber in front of each being designed to throw the heat forward and upward, where it impinges on the lower side of the wall of sections to be heated. The flame then is deflected to the back of the furnace and passes around the rear of this baffle and over the top of the sections to the stacks at the front. Great flexibility is possible, the quantity of fuel and pressure being regulated readily to suit conditions. In heating large sections, greater pressure is necessary than for smaller ones, as the former remain in the furnace a shorter period and present a greater thickness of material to be penetrated. The furnace is employed in heating H-sections of a special type which are used in the production of expanded trusses, a new product recently put on the market. In front of the furnace, as in Fig. 2 is a table on which the steel sections are placed, with the webs horizontal. As each heated beam is removed from the rear, hydraulic plungers push the entire mass into the furnace a distance equal to the width of one section. One heated section is removed from the furnace every three minutes. Inasmuch as the furnace is required to handle H-sections varying from 4 x 4 inches to 8 x 8 inches and from ¼-inch to ½-inch in thickness, great flexibility is necessary to bring the various pieces up to the requisite temperature without shortening or lengthening the heating period. It is said that difficulty has been experienced in regulation to meet these demands.

FIG. 2—FRONT VIEW OF OIL REHEATING FURNACE

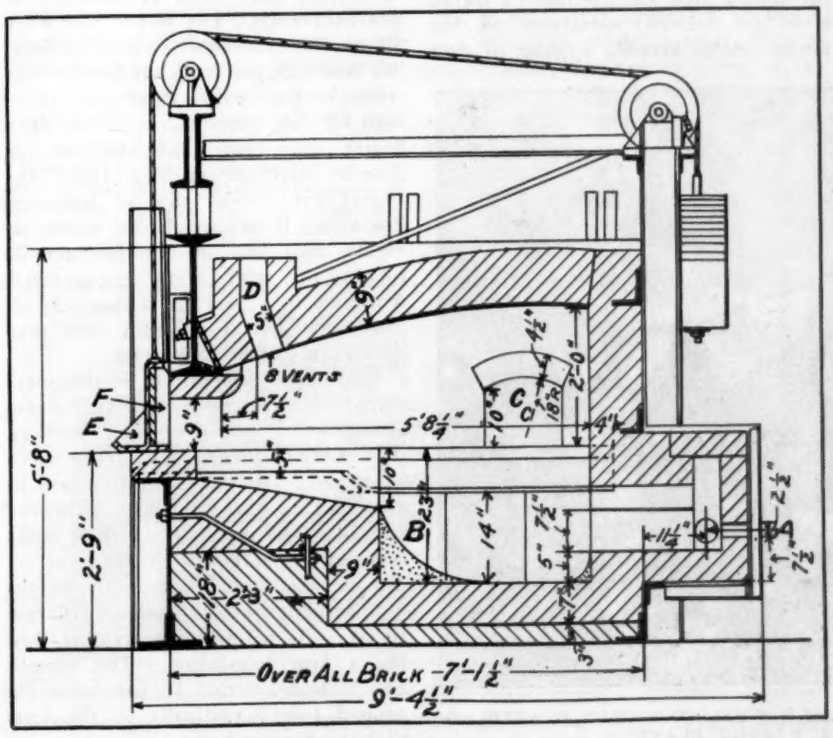


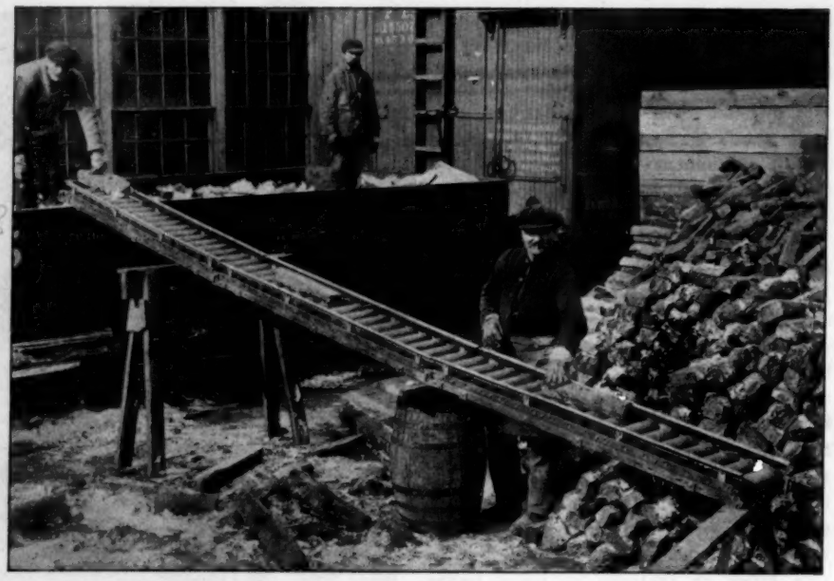
FIG. 1—CROSS SECTION OF OIL REHEATING FURNACE

The construction of the furnace is shown in the cross section, Fig. 1, the oil burner being at *A*. The flame is thrown by pressure into the combustion chamber *B*. It strikes the bottom of the layer of H-sections, which deflects it, leading it to the stack outlet *D*. The cold sections are introduced at *E* and the hot pieces are discharged through the door *C*. A series of doors, *E*, operated by counterweights, rests on top of the layer of H-sections, making the furnace front tight.

The total importation of iron construction and roofing materials at Port Limon, Costa Rica, is valued at about $300,000 per year, but much of this is intended for sale in the interior cities of Costa Rica. However, the greater part of this business is done by firms having branch houses in both Port Limon and the San Jose districts. The United States furnishes about 50 per cent of the total, Great Britain about 33 per cent and Germany 15 per cent.

Unloading Pig Iron With Gravity Carrier

To facilitate the unloading of pig iron from cars and to direct its delivery to almost any point in the stock yard where it is to be piled, the gravity carrier, shown in the accompanying illustration, effects big economies in the handling of this raw material. It is the customary practice to unload pig metal from cars into a pile at the side of the car and then to convey it in cars, or by hand, to a point in the yard where it is to be piled. The gravity carrier eliminates this unnecessary handling and the laborers unloading the pigs only are required to place them on the rollers of the carrier which delivers them to the point in the yard where they are to be piled.



GRAVITY CARRIER INSTALLED AT THE PLANT OF THE STANDARD STEEL CASTINGS CO. BY MATHEWS GRAVITY CARRIER CO., ELLWOOD CITY, PA.

The gravity carrier in the accompanying illustration was installed in the plant of the Standard Steel Castings Co., Cleveland. It is of a standard type utilized for handling pig iron and is equipped with 3¼-inch steel rollers made from hot rolled steel tubing No. 11 gage. These rolls are provided with detachable ball bearings and are assembled in steel frames 6 feet long, the rolls being spaced 3½ inches from center to center. A guard rail is provided with a 12-inch clearance. As many units as may be required can be assembled to deliver the pigs from the cars to distant points in the storage yard. The carrier will operate on grades as low as 4 to 8 per cent, according to the character of the pig iron handled. Machine-cast metal can be delivered on a 4 per cent grade, while sand-cast pigs will require approximately an 8 per cent grade. In this illustration the pigs are of the sand-cast type. Ninety degree curves also are furnished to direct the line of the conveyor either to the right or left.

Excavates With Mine Shovel

Faced with the task of excavating about 320,000 cubic yards of material preliminary to the erection of its new open hearth and finishing mills at No. 2 plant, Indiana Harbor, Ind., the Inland Steel Co. has taken a lesson from its mining operations in the north. After keeping a gang of men at work for two weeks with shovel and pick, their progress being scarcely noticeable, the engineers in charge decided something had to be done to make the dirt really move. Accordingly it was decided to apply mining methods. A steam shovel and two trains of dump cars were brought from the Thompson mine at Crosby, Minn., and set to work. The dipper on the shovel has 2½ yards capacity and takes a slice 16 feet deep and 30 feet wide at each trip. About 2,500 yards a day have been moved under favorable circumstances.

Peculiar conditions, presenting some difficulties, have been encountered in this excavation. The dirt is part of a fill on the lake shore, where material has been dumped from the steel works throughout its entire existence. Huge hobs of slag, from ladles in the open hearth plant, are imbedded in the ground, and on striking these the shovel runs great risk of breaking. Some of them weigh as much as eighty tons and in one instance 22 inches of steel were encountered, workmen in a past day apparently allowed the metal to cool and then dumped it to hide their error.

With mining operations in the north claiming the services of the steam shovel for a season of great activity, it will be returned to Crosby in a short time, and the excavation will be continued by three smaller contractors' shovels. The material, which is being dumped on the lake shore to form additional land, on which some of the new buildings will be erected, is largely slag. It will compact readily, giving a firm foundation. The excavation is being carried 16 feet below the ground level, practically to the level of Lake Michigan.

STEAM SHOVEL EXCAVATING FOR INLAND STEEL CO.'S OPEN HEARTH ADDITION AT INDIANA HARBOR PLANT

How to Correct Dynamic Unbalance

THE PROBLEM of balancing revolving parts has been confronted by manufacturers of all kinds of machinery for many years. Many attempts to correct unbalance have been carried on along irrational assumptions. This article describes a balancing machine which is constructed on the correct principles

BY N. W. AKIMOFF

THE balancing of reciprocating parts is purely a matter of calculations and of design; but the balancing of rotating parts, aside from the design, is a matter of trial and adjustment, because of its accidental nature.

In a theoretically perfect rotating body, symmetrical and made of homogeneous material, there cannot be any question of running balance. But we know in practice nearly all bodies rotating at high speeds show a certain amount of unbalance. The immediate consequences of this unbalance are vibrations in automobiles and turbines; defective commutation in electrical machinery; undue wear and strain on bearings; defective products in the cases of grinding disks for steel balls, woodworking machinery, etc.

As is well known to all, an unbalanced condition of a rotating body may be due to lack of static balance or lack of dynamic balance.

By static balance is understood the condition when the center of mass of the body lies somewhere on the axis of rotation. Such a condition is easily obtained on one of the static balancing machines of the knife-edge or of the roller type. In order to place the body into static balance, it is sufficient to drill one hole or to add one weight, although either of these might be split up into one or more components whenever desirable, all of which does not present any special difficulties.

By dynamic balance is understood the condition when there is no so-called centrifugal couple in any axial plane. In a statically balanced body a centrifugal couple can only be due to two masses on opposite sides of the shaft and located at a certain distance axially from each other. Such masses may be, for instance, the centers of gravity of corresponding congested regions. At any rate, in view of the static balance, such masses must be in some axial plane, and the products of each mass and its respective distance from the axis of rotation must be equal.

Since the effect of a couple can only be counteracted by that of another couple, it will be seen that any effort to balance such a body by adding one weight, or drilling one hole, cannot fail to make matters worse. Such a method not only does not take care of the centrifugal couple, but also distorts the static balance.

It is absolutely necessary to know, in a statically balanced body, the exact location of the axial plane of the disturbing centrifugal couple, the exact numerical value of the disturbing couple and the sign of the couple.

Indeed, with the axial plane of the disturbing couple known, attention can be limited to that plane; and what is done on one side of the shaft will be repeated on the other side so as to preserve the static balance. Furthermore, with the numerical value of the couple known, all that has to be done to secure dynamic balance is to introduce an opposing couple of the same magnitude. Of course, this counteracting couple can be introduced in a variety of ways, small holes drilled on a large radius and far apart axially being equivalent to larger holes located on smaller radii and nearer to each other axially.

It will be seen from the above that a machine to deserve the name of dynamic balancing machine absolutely must indicate the plane of unbalance, as well as the numerical value and sign of the unbalancing couple. The author claims to have produced such a machine, of which the following is a brief description.

A rigid horizontal beam, such as a lathe bed, Fig. 2, is hinged at one end and supported by a spring at the other. The body to be tested, already in perfect static balance, is rotatably supported on the beam. If dynamically unbalanced, the body will, when rotated, cause the beam to vibrate in a vertical plane, with a period of oscillation equal to the period of rotation of the body. In other words, if the speed of the unbalanced body is, say, 315 revolutions per minute, the beam will vibrate at the rate of 315 complete oscillations per minute, quite regardless of the characteristics of the spring, except possibly at the very beginning of motion. Now

Presented at the spring meeting of the American Society of Mechanical Engineers at New Orleans, April 14, 1916. The author, Mr. Akimoff, is engineer, Dynamic Balancing Machine Co., Philadelphia.

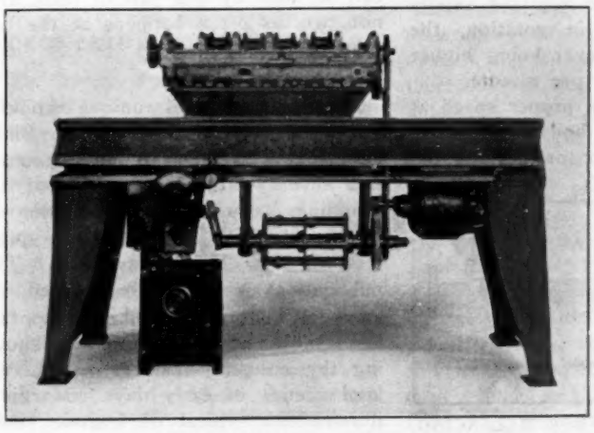


FIG. 1—DYNAMIC BALANCING MACHINE BALANCING AUTOMOBILE ENGINE AXLE

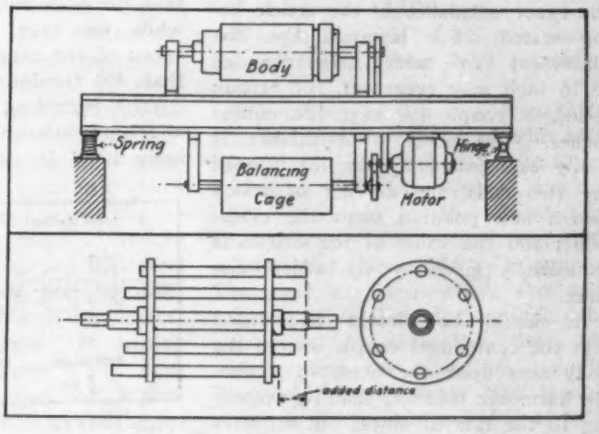


FIG. 2—PRINCIPLE OF THE BALANCING MACHINE
FIG. 3—CONSTRUCTION OF SQUIRREL CAGE

imagine a second body, exactly similar in every respect to the first, also in perfect static balance but dynamically unbalanced to precisely the same extent as the first body, temporarily associated with the same beam, say suspended under it.

If these two bodies are oppositely located as to balance and run precisely at the same speed, synchronously, then the unbalancing or disturbing couples will cancel out, and the beam will have no tendency to vibrate, no matter how badly unbalanced, individually, are the two bodies. This is the fundamental principle of the machine, to determine unbalance by determining the unbalance necessary to neutralize its effect.

In the actual machine instead of the second body being an exact image of the original unbalanced body, it is a so-called squirrel cage, and this is rotated in unison with the article to be tested. The cage, Fig. 3, consists of two or more circular disks, carrying an even number of rods, usually six or eight, arranged slidably in the disks. The rods are accurately made and their common weight is known; therefore, any displacement of one of the rods with respect to the one exactly opposite will not affect the static balance, originally perfect, of the cage, but will introduce a certain centrifugal couple, according to the relative displacement or added distance.

For instance, suppose that the unbalanced body is a special fan, Fig. 4, and that the unbalance is due to two excess weights, grossly exaggerated in the figure. This will result in a centrifugal couple, and to counteract it, the cage will have to be put into a state of unbalance, as shown by the relative displacement of the rods and as measured by the added distance.

Thus the cage has means for indicating the exact amount of unbalance which has been put into it in order to reproduce with the opposite sign the exact unbalance of the article being tested. For instance, the displacement or added distance of 15/16 inch may represent, for certain speed, a couple of, say, 120 ounce-inches. The plane of unbalance is easily established by the location of the two rods, the moving of which into a new position stops the vibrations; and the value of the couple is immediately given by the added distance.

It should be clearly understood that the centrifugal couple due to the body acts upon the beam in a simple harmonic manner, that is, according to the law of sines; but so does the effect of the balancing cage. In

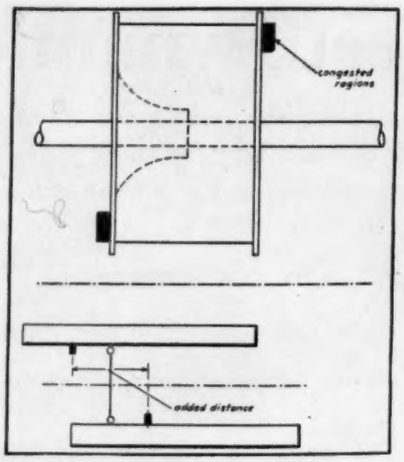


FIG. 4—DYNAMIC UNBALANCE IN A SPECIAL FAN

other words, when the axial plane of unbalance is vertical, the effect of unbalance on the hinged beam is the greatest, as also is the effect of the correcting element, the cage.

When the plane of unbalance is horizontal, that of the correcting element is likewise horizontal, since the cage and the body rotate in unison, and neither is in any manner felt by the beam which does not respond visibly to any but vertical efforts or the vertical components of other couples.

So far as the spring is concerned, its object is to intensify the amplitude of the vibrations, although an unbalanced body will always cause the whole bed to vibrate with a frequency corresponding to the speed of the body.

However, there is an additional advantage in the use of the spring, as it is always possible to select the characteristics of this so that, under its load, its free period of oscillation will correspond exactly to the rate at which it is desired to run the test. Such a synchronism has a large magnifying effect, so that even a slight unbalance results in a considerable amplitude of oscillation.

The main feature of the cage is that the rods can be adjusted axially while the cage is in rotation, the speed of the cage never being higher than 400 revolutions per minute.

With regard to the proper speed at which to balance a body, unless the body itself is elastic or is mounted

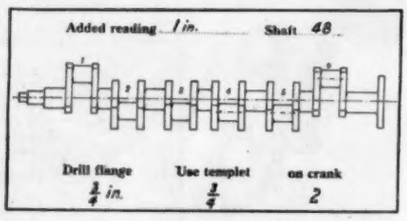


FIG. 5—DIRECTIONS FOR BALANCING SHAFT

on a flimsy shaft, the body balanced at any speed will run true at any other speed. If the shaft is not strong enough, no balancing machine can make it stronger. If the windings of a rotor seek to find their places under a certain speed and temperature, they should be allowed to do so, after which balancing can be done. In the high spot metnod, in which azimuth, commonly known as lag or lead, depends upon the speed itself, it is of course of considerable importance to watch the speed; but in the rational method here proposed the best speed is determined only by the characteristic of the spring.

Fig. 1 illustrates a dynamic balancing machine for testing automobile crankshafts previously placed in perfect static balance. The information furnished by the machine is simply the relative displacement known as added distance of one of the pairs of rods of the squirrel cage. By referring to a set of specially prepared tables, similar to the one shown in Fig. 5, the operator can pick out readily the necessary directions as to how to remove a certain amount of metal from one of the cranks, and how to drill the flange in order to secure perfect dynamic balance.

It is not necessary to dwell on the extreme importance of testing a body for unbalance in its natural position and upon its own bearings. This machine, in its very conception, is adapted for testing under such conditions. The shaft in Fig. 1 is being tested in its own crank case.

Theoretically, one pair of rods in the squirrel cage, Fig. 3, of the machine would suffice, since the relative position of the rods to the body being tested can be altered readily enough through the chain drive shown in Fig. 2. For convenience, however, it is best to have three or four pairs of rods, and even then it is sometimes necessary to change the angular posion of the cage so that the balancing can be done by one pair of rods, and not two, as often happens at the beginning of a test.

A handsome and unique booklet has been published by the W. Bingham Co., Cleveland, to commemorate the seventy-fifth anniversary of its founding, as well as the occasion of its moving into large, modern quarters on New Year's day, 1916. The publication is strikingly printed on an ivory matt paper and includes facsimiles of many old engravings showing the company's stores and Cleveland scenes in early days. Marginal illustrations typical of bygone times also lend interest to the booklet.

WHAT'S WHAT and WHY

Don't Ask Yourself-Ask Us!

Questions from our Readers answered by Experts

Method of Distilling Zinc

What is the method of distilling zinc in the manufacture of spelter?

The peculiar chemical properties of zinc limit the possible types of furnaces and successful spelter furnaces therefore have the same general characteristics. The furnace consists of a chamber with a solid roof and solid walls on three sides. The fourth side is an open frame of fire-brick. Retorts closed at one end are placed in this chamber, resting on the open front frame and on brackets connected to the back wall. The outer, open ends of the retorts project slightly from the furnace and the space around them is made tight with a clay luting. When the furnace is sufficiently hot, the charge, consisting of a mixture of crushed ore and coal, is thrown into the retorts with considerable force, so as to pack it tightly. Short clay cones, called condensers, are fitted into the open ends of the retorts and luted-up with coal. The large ends of the condensers are placed in the retorts, the outer ends being supported on pieces of brick resting on shelves in front of the furnace, or on movable iron rests called grasshoppers. As the distillation proceeds the zinc vapors are condensed and trapped in the condensers.

Recovering Iron from Slag

We operate a merchant blast furnace and tests have indicated that considerable iron is lost in the slag which is drawn off into cinder ladles at regular intervals in the customary manner. Can you suggest a practical method of recovering this material?

A furnace in the middle west has solved this problem in a fairly satisfactory manner by means of an auxiliary runner which is led off at right angles from the main slag runner at a point about 35 feet from the furnace. This runner is so arranged that it drains only the lower part of the main runner. A low dam also is laid across the main runner in order to stop and divert any iron which may have separated out of the slag in the course of its downward travel. It is said that the iron recovered in this manner from a 450-ton furnace varies from 400 to 900 pounds per day. This iron is run into a separate pig bed.

Materials Producing One Ton of Pig Iron

What materials, giving weights, are charged in the production of one ton of pig iron?

The average at American blast furnaces is approximately 4,000 pounds of iron ore, 2,000 pounds of coke and 1,200 pounds of limestone. The blast required for the production of 2,240 pounds of pig iron is 9,000 pounds. The yield is 2,240 pounds of pig iron, 1,600 pounds of slag and 12,360 pounds of tunnel head gases.

Express Companies Profit

It has been rumored that the express companies have profited by the present freight congestion in the east. Is there any truth in these reports?

The express companies have been doing a large business with companies which previously have never shipped material by express. It is not uncommon to ship automobiles by express, and there is one case on record in which automobiles to the value of $100,000 were shipped from Flint, Mich., to Boston in a single express shipment. A 25-ton hydraulic press was sent from Philadelphia to a New England city by express to avoid the delay of freight shipment. Four carloads of structural steel were shipped from the Pittsburgh district to a manufacturer in Massachusetts, at express rates. In smaller shipments, averaging from a few hundred pounds to three tons, the employment of express rather than freight facilities has been even more general.

Higher Prices for Automobiles

Are the prevailing high prices of steel and other metal products having any effect on the prices of automobiles?

The increased cost of iron, steel, copper, aluminum and spelter naturally has had a marked effect on the cost of manufacturing automobiles, and this condition has brought the automobile manufacturers face to face with an exceedingly perplexing problem. The leaders in the automobile industry realize that the success of the business rests on car prices within the reach of the average buyer. At the same time the cost of materials has increased so tremendously during the past year that increases in the retail prices of machines seem inevitable. Two automobile builders already have increased the prices of their cars by $100 and $200 respectively, and it is known that practically all automobile manufacturers in Detroit and other leading centers are seriously considering similar advances. One prominent eastern motor car manufacturer estimates that the increase in the price of aluminum alone will add $600,000 to his cost of production this year.

Yield of Steel from Iron Ore

What is the yield of pig iron, ingots, slabs and plates from 2,000 pounds of iron ore?

The output of pig iron from 2,000 pounds of iron ore, reduced with 1,000 pounds of coke and 600 pounds of limestone, is 1,120 pounds, and of ingots produced by the open-hearth steel process, 1,000 pounds; slabs 910 pounds, and plates 710 to 730 pounds. The yield as the finishing processes progress is smaller; for example, the production of sheets is only 651 pounds, and tin plate 643 pounds. The yield of wire from 2,000 pounds of ore is 796 pounds and that of nails 765 pounds.

Why Standardize Machine Tools?

A COMPREHENSIVE survey of the part played by machine tools in a modern military conflict. The author outlines the organization that would be necessary for the control of the purchase and manufacture of machinery in this country in case of war—It is important that tools be properly standardized

BY L. P. ALFORD

THE importance of machine tools in time of war is strikingly proved by comparing the machine-tool exports from the United States for the calendar year 1915 with the record of the best previous year in our history. In round figures $42,000,000 worth of machine tools were shipped during 1915, while the highest preceding yearly record was about $16,000,000. The influence of the European war has multiplied our average machine-tool exports some three times.

Although there has been some scattered buying during the last 20 months, the greatest number of the machine tools exported from the United States have been taken by Great Britain, France and Russia. Exports have been cut off to Germany and Austria, while the Scandinavian countries, Holland, Italy, have increased their buying much beyond the normal amount. But little is known in this country of the methods that Germany has employed to build and maintain the machine tools necessary to produce her munitions of war. On the other hand, there is considerable information available in regard to the methods employed by Great Britain and France. Thus it is from the experiences of these latter named countries that we are at the present moment concerned. From their methods we can formulate the principles of action to govern the design, purchase, production, and distribution of machine tools in preparing for the emergency of war.

The Backbone of Defense

The events of the past 20 months have justified the statement that the machinery building industry is the backbone of any defensive or offensive warfare at the present day. This condition emphasizes anew the need of carefully considering machine tools in any plant for industrial preparedness.

The machine tools shipped abroad within the past 20 months fall into three general classes: First, simple, plain machines that were either standard with certain manufacturers before the outbreak of the war, or have been designed and built under the stress of the tremendous foreign demand; second, regular machine tools of a more highly organized grade, particularly automatic machines that were standard products of some manufacturers prior to the outbreak of war; and third, special machine tools developed for some operation or series of operations in the manufacture of some particular detail of munitions. The latter group includes lathes for the outside turning of shells, lathes for boring shells, and lathes for waving, grooving and undercutting shells. The first class comprises by far the greater volume of the exports, and simple lathes are the predominating machines. In like manner, lathes predominate in the third class.

Organizing Industrial Preparedness

In the preceding issue of The Iron Trade Review, in connection with the report of the annual spring meeting of the American Society of Mechanical Engineers at New Orleans, we presented a series of discussions by eminent men on the vital subject of industrial preparedness. Two additional discussions are published herewith. One, by L. P. Alford, editor, The American Machinist, deals ably with the important problem of securing an adequate supply of machine tools, and points out the necessity for standardization in this industry. Mr. Alford's paper is followed by a timely discussion by Henry L. Gantt, in which the causes of German military and industrial superiority are analyzed.

The methods adopted by Great Britain, France and Russia in buying these machine tools need brief consideration. The early orders were placed by European machine-tool agents who had handled American machine tools for years. Their knowledge of the business gave them the first entrance into the field.

These dealers' contracts were followed by others given by special agents or government commissions who came over to this country during the first year of the war. These orders brought about a condition of scarcity of machine tools in the United States, and at the same time filled all the regular machine-tool building plants with such a volume of business that deliveries in many cases have been seriously delayed. The third class of buying has been by government commissions, the orders being placed with shops making high grade machinery other than machine tools, such as printing presses and woodworking machinery. In general these orders have been for machines of the third class previously mentioned. Their buying has been most ably managed, and the results of their work has been more uniformly successful and satisfactory than that of any of the private buyers.

The private buying, that is, the buying done by machine-tool dealers, can be divided roughly into three periods. During the first period simple lathes and turret machines were bought almost exclusively. The demand during the second period was for grinders, drilling machines and millers. The demand during the third period was for planers, shapers and tool-room machinery.

After learning from the hard school of experience, it is now realized that tool-room machinery should have been bought during the first period. The reason is obvious, for such machines are needed to produce the jigs, fixtures and gages which are the necessary accompaniment of machine tools for duplicate production.

In case of war with a first-class power, the United States would unquestionably need to add an enormous number of machine tools to the present equipment of its machine shops.

Buying Agency is Necessary

Based on the record of the years immediately preceding the outbreaking of the war, the normal surplus of machine-tool production of the United States, as represented by the amount shipped abroad, has a value of about $15,000,000. This supply would naturally be kept at home, but in addition thereto we would have to draw from the industrial nations of Europe, provided we were not involved in an European war. This buying would have to be done by some organization not now in existence, for the reason that there are only a few agencies in this country that market European-made machine tools here.

Thus, the European buying for the United States would have to be placed in the hands of experienced men, perhaps civilians representing both builders and users. The present British ministry of munitions with its sub-committees might well form a model for the American organization charged with the duty of buying machinery abroad. There are facts that tend to prove that the work done by the British commission has been most efficiently handled, and has brought excellent results. This is an experience well worth careful weighing.

Suppressing Speculation

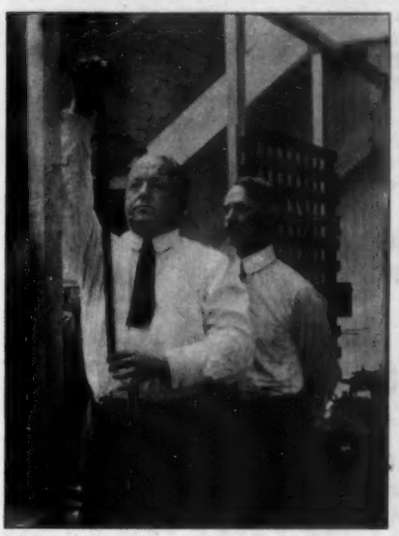
One of the early acts of the British ministry of munitions was the prohibition of the importation of machine tools into Great Britain, except under license of the ministry. A number of reasons led up to this decision. Among them is the necessity of suppressing speculative buying and selling, controling the kinds of machine tools bought abroad, the effective utilizing of ocean-borne freight, the distribution of machine tools in a manner to best further the manufacture of munitions, and the control of quality.

As stated previously, but little is known of the conditions that have surrounded the machine-tool industry in Germany during the war. However, at the outbreak of the war, edicts of the ministry of war placed a prohibition upon the exportation of machine tools as one of the items in a list of articles that might be of value to the enemy. As the war progressed, the ministry formed two committees, one the war raw materials committee, and the other the industrial committee. These committees have controled the machine-tool industry as well as other German industries. They have directed what machines should be built, where they should be built, have handled the supplies of raw materials for machinery building, and have arranged for the distribution of the new machines as well as other machines that could be released from their regular employment. It is reported that France mobolized the machine tools of the republic as one of the early war measures.

Thus from the experience of Great Britain, Germany and France the necessity of controling the supply and distribution of machine tools is evident in case of war between first-class powers.

Could We Obtain German Tools?

No exact estimate can be given of the number of machine tools that might be immediately available in Germany in case there should be an emergency demand from the United States. A careful estimate for Great Britain, however,



FRANK B. GILBRETH

As a result of his experiences abroad Mr. Gilbreth contributed an interesting discussion to the symposium on industrial preparedness at the A. S. M. E. meeting in New Orleans. In this illustration Mr. Gilbreth is shown examining a film in his motion-study laboratory

is that under normal conditions there are some 1,200 to 1,500 lathes in stocks of dealers and builders. In any event, it is fair to assume that the stock of machine tools in the possession of dealers and builders in Europe would not be very great, and in fact would be a very small factor in the problem. Accepting this situation as a starting point, a decision can be made as to whether the United States should buy standard machines regularly manufactured abroad, or order special machines particularly adapted to our own needs. It is conceivable that it might

FRED J. MILLER

Mr. Miller is works manager for the Remington Typewriter Co., a position which has given him unusual opportunity to study the problems of industrial preparedness. Mr. Miller's discussion was published on page 882 of the April 20 issue of *The Iron Trade Review*

be much better to have machines built to our own drawings and specifications than to attempt to use the regular products of European builders.

Standardization is Important

In his paper on organization for industrial preparedness, published in *The Iron Trade Review* April 13, Spencer Miller pointed out the necessity of standardizing machine tools. If they are to be standardized for our own makers and needs, it follows that the machines bought from Europe should be uniform with those produced here. Without question, machine tools should be standardized, and the motive of industrial preparedness should be sufficient to inaugurate the study and work of standardization at once.

Turning again to the European situation, it is estimated on reliable authority that the plain lathes of, say, 16 to 24 inches in swing, could begin to be shipped from the British machine shops in 12 weeks from the receipt of detailed drawings of their parts, and detailed specifications for their manufacture. Not only could they be procured in this time from machine-tool building shops, but from other machine shops accustomed to doing high grade work. Broadly speaking, any machine shop that is accustomed to do accurate planing and scraping can build machine tools under conditions of demand such as exist at the present time.

Because of the small stocks of machine tools in Europe, it is evident that not many could be obtained during the brief period of waiting for American standardized construction to be produced. It is, of course, possible that the essential standardized details could be reduced to a minimum with the insistence that these should be incorporated in the regular designs of European builders. In this way the essential needs of uniformity with American products would be met, and it is possible that a certain amount of time could be saved over the estimates given above.

The Principles Involved

From the experience of the allied nations in purchasing machine tools during the past 20 months, it seems justifiable to lay down the following principles for the standardization and purchase of machine tools in organizing for American industrial preparedness.

1—Organize at once in skeleton form an industrial committee to control standardization, design and preparation of machine tools for the production of American munitions.

2—Through joint action of this committee, the American Society of Mechanical Engineers, and the National Machine Tool Builders' Association,

standardize the details of regular machine tools, and design whatever additional special machine tools may be necessary for the rapid and economical production of American munitions.

3—Immediately on the outbreak of war, prohibit the exportation of any machine tools from the United States.

4—Immediately on the outbreak of war prohibit the importation of any machine tools into the United States except under license and control.

5—Order all machines abroad through the industrial committee or its representatives in the capitals of Europe, and entrust these men with the responsibility of securing the desired deliveries and quality.

6—Order no machine tools abroad except to standardized American designs, either for the complete machine or the essential details as the committee may determine.

Turning now to the important matter of standardization of machine tools, this subject was thoroughly talked over at a convention of the National Machine Tool Builders' Association a few years ago. However, as that body is a business rather than a technical organization, no efforts have been made to bring about uniformity. The suggestion has been offered that this work of standardization should be done jointly by the American Society of Mechanical Engineers, the industrial committee, which is outlined in this paper, associated with the National Machine Tool Builders' Association.

Preparedness is Ability to Do Things

BY HENRY L. GANTT

IN CONSIDERING the subject of preparedness, either for peace or for war, it is imperative that we learn, as quickly as possible the lessons which are being made clear to us by the developments in Europe. In order to do this, we must ask ourselves why it is that Germany has shown so much greater efficiency, both from a military and an industrial standpoint, than the allies. It is becoming perfectly clear that the principles underlying industrial and military efficiency are the same and that a nation to be efficient in a military sense, must first be efficient industrially.

A Lesson to be Learned

We have talked efficiency in this country for several years, and many books have been written on the subject, but many of us feel that the actual results so far have been lamentably small. It is believed we would be much more nearly in the class with England than with Germany if we were suddenly confronted with her problem. It would seem, therefore, that we should find the fundamental reasons why England presented such a strong contrast to Germany, and see if we cannot learn something therefrom.

It is only a short time since England led the world in arts, but recently Germany has demonstrated her superiority to both England and France.

We must ask ourselves how this happened. It would seem to be something on this manner. The financiers of England, feeling that wealth could purchase whatever was needed for themselves and their national life, have devoted their energies for a number of years to securing wealth which was produced by others rather than making strenuous efforts to produce it themselves. In this attempt they sent abroad millions of dollars to develop industries in foreign lands, which brought them great returns. The leaders of Germany, on the other hand, not being able to exploit foreign peoples to the extent which was possible in England, turned their attention to developing their own resources, and the ability of their own people. When the supreme test came, Germany was found to be a nation of people who, in general, knew what to do and how to do it; while the industries of England were, in too many cases, controled by people who understood only their commercial side.

HENRY L. GANTT

Mr. Gantt's experiences as an efficiency engineer have led him to examine the causes of German military and industrial superiority

Is Financial Strength Paramount?

We, following the footsteps of England, have regarded financial strength as the most important strength; forgetting the comment which the ancient philosopher made to the rich man who boasted of his possessions: "What availeth all thy wealth? He that hath better iron than thou will come and take away all thy gold". In those days iron meant weapons. Today iron may be taken as the symbol of both weapons and tools of industry, and the statement is just as true today as it was two thousand years ago, that he that hath the better tools is more powerful than he that hath the wealth.

The move, therefore, to get the engineers of this country working together for preparation is a most hopeful sign, for in the strenuous times in which we are living, wealth may be of a little more value to us than it would have been to Great Britain, but for the 20 miles of water which separated her from the Continent of Europe.

On the other hand, the power to do things cannot be taken away from us The greater the power, the more important will its possessor become, as we realize the real meaning of the titanic contest which is now going on in the world. The engineer is preeminently the man who knows what to do and how to do it. The new world, therefore, which is being ushered in by the great struggle now taking place is one in which the engineer is destined to be the supreme power, for it is becoming increasingly clear that, in future, the man who owns things will not be as important a factor in the world as the man who can do things.

The Automobile Industry

The latest statistics of motor car manufacturers in the United States shows that 34 states now have motor car factories, and the total number is 463. Michigan leads the list with 86. Then follow in order New York, with 60; Ohio, 52; Illinois, 47; Indiana, 45; Pennsylvania, 35; Massachusetts, 17; and the others with from one to 16. The complete list follows:

California	13	New Jersey	10
Colorado	3	New York	60
Connecticut	7	North Carolina	1
Delaware	2	Ohio	52
Georgia	1	Oklahoma	1
Illinois	47	Oregon	2
Indiana	45	Pennsylvania	35
Iowa	6	Rhode Island	1
Kansas	3	South Dakota	1
Kentucky	3	Tennessee	3
Louisiana	1	Texas	3
Maine	1	Utah	1
Maryland	4	Virginia	1
Massachusetts	17	Washington	6
Michigan	86	West Virginia	1
Minnesota	15	Wisconsin	14
Missouri	16		
Nebraska	1	Total	463

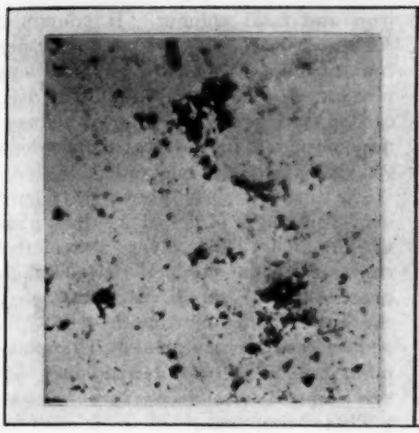


Fig. 1

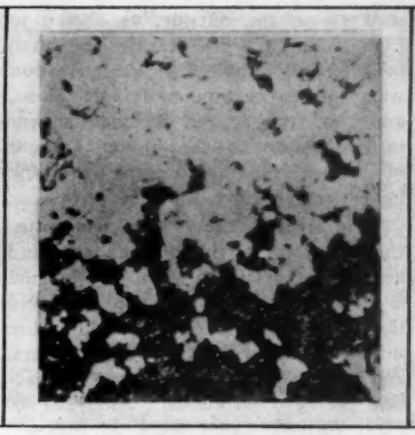


Fig. 2

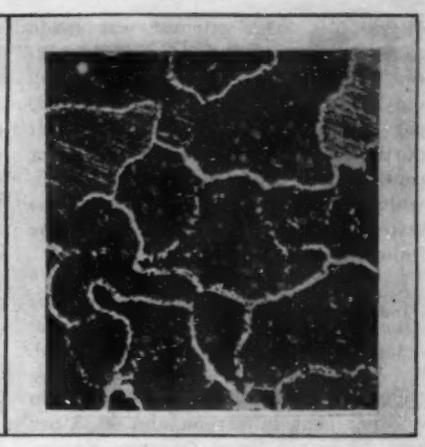


Fig. 3

Furnace Gas Carburization of Iron

BY T. H. BYROM

DURING the process of cleaning and repairing pipes conveying blast furnace gases, a few years ago, the author's attention was called to an extremely brittle plate which had been removed from one of the pipes. On inquiry it was found that it had been broken out of the center of what was originally a soft steel sheet 7/16-inch thick, which had been placed in the flue to divert the stream of gas through a dust-catcher. The central portion only being brittle, and the surrounding parts being sound, the plate was patched and replaced in the same position. The plate had been exposed to the hot furnace gas for several years, at a temperature probably not exceeding 500 degrees Cent. The fracture of the piece somewhat resembled that of very high carbon tool steel, though it was not so metallically lustrous. The results of subsequent investigation along the lines suggested by this discovery are embodied in this paper, although many of the points to which they gave rise could not be investigated fully at the time. Among these were, for instance, the possibility of action due to the presence of a manganese carbonyl, analogous to iron carbonyl, and the probable presence and reaction of carbon oxy-sulphide. The analysis of the brittle portion of the plate, after removing the dust from the surface, was as follows:

	Per Cent.	Probable Analysis of Steel. Per Cent.
Iron	89.600	....
Carbon	7.60	0.15
Manganese	0.25	0.27
Silicon	trace	trace
Sulphur	0.55	0.050
Nitrogen	0.012	....
Phosphorus	0.030	0.033
Not determined	1.958	....
	100.00	

Specific gravity	6.56
Specific gravity of soft steel	7.80

From the analysis it is evident that the steel had been completely converted into carbide of iron, as in the cut sections in Figs. 1 and 2. The specific gravity compared with the original steel indicates that during carburization 100 volumes of the steel had expanded to 119, an increase of nearly 20 per cent. As the thickness was not increased, the expansion must have been lateral. That this had taken place was proved by the buckling of the plate, in places beyond the brittle area.

When a piece of the cemented plate was placed in water, streams of bubbles ascended from the surface, indicating porosity. It was very hard and brittle, could not be cut with a saw, and was reduced to fine powder in a steel-crushing mortar. The powder was practically insoluble in dilute sulphuric acid, and hydrochloric acid. After treatment with these acids about 2 per cent soluble matter was removed and the residue, after washing with water and alcohol and drying, contained on analysis the following:

	Per Cent.	Portion Magnetically Separated. Per Cent.
Total carbon	7.35	7.42
Amorphous carbon	0.16	trace
Carbon combined	7.19	7.42

The high carbon in this residue suggested the presence of a mixture

A paper read before the British Iron and Steel Institute, at a recent meeting.

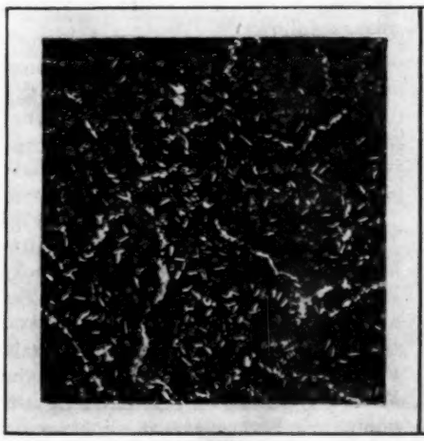


FIG. 4

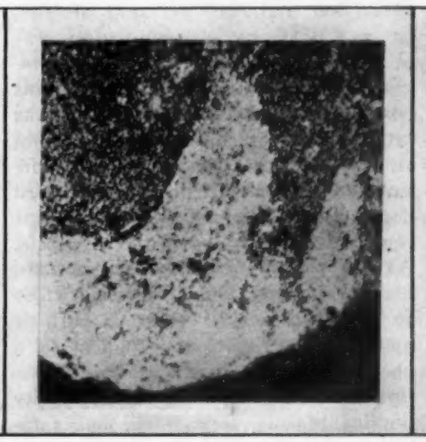


FIG. 5

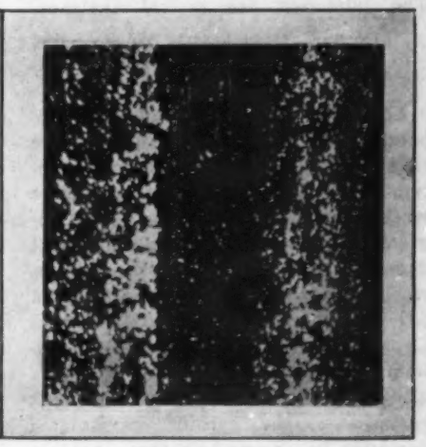


FIG. 6

of carbides. An attempt was made to separate them by fractional solution. This was done by digesting the fine powder in nitric acid of 1.20 per cent specific gravity. The last portion, which included about 15 per cent of the total weight of powder, which remained undissolved, was tested for carbon and iron, with the following results:

	Per Cent.
Carbon	9.45
Iron	89.30
Not determined	1.25
	100.00

Pure ferric carbide should contain 9.67 per cent of carbon and 90.33 per cent of iron. From this experiment, it would appear that the carbides were a mixture and not a simple carbide.

As this is the first time on record, as far as is known, of carburization being effected by hot blast furnace gases, three series of experiments were made, to learn whether iron could be readily carburized by the gases from blast furnaces, and at what rate carburization could be effected. With that object in view, strips of pure electro-deposited iron were suspended by iron wire in the gas flues of furnaces and were maintained in position for varying periods. The strips of electro iron were about 0.015 inch in thickness. In about one week the strips became quite brittle, and in a fortnight many of them broke away and were lost.

On careful examination of the pieces after they had been exposed for a fortnight, it was found that the iron was covered or sheathed by readily detachable layers of carbide of iron, which had been formed on each side, whilst in the center there was a more or less exceedingly thin malleable sheet, which, on bending, broke readily at the boundaries of the crystals. The separated crystals were exceedingly ductile, indicating that they had not been converted into carbide, as shown in Figs. 3 and 4. The following are typical analyses:

	Outer Layers. Per Cent.	Whole Section. Per Cent.
Carbon	6.96	2.10

The pieces of electro iron were suspended by impure wrought iron wire rods of about ¼-inch diameter. When removed, the specimens in places where the temperature was 400 degrees Cent., were not in the slightest degree carburized, but in other places, where the temperature varied between 550 degrees Cent. and 650 degrees Cent., the carburization was most pronounced. The wrought iron rods were also carburized, and, what is most remarkable, the carbide in isolated particles had formed in the center as well as on the outside, as shown in Figs. 5 and 6. The results indicated satisfactorily that the carburization was due to carbon monoxide alone, and that the action becomes slower in proportion to the higher amount of carbon dioxide present and the lower temperature.

Theoretically, the gas penetrates the iron, is partly decomposed and ceases to carburize when equilibrium is established between the iron and the carbon dioxide. The inert mixture diffuses outwardly, new gas enters, and carbon again is deposited, the action being continuous. Analyses of blast furnace gases were as follows:

	A Per Cent.	B Per Cent.	C Per Cent.
N_2	60.50	60.50	61.00
CO	34.20	34.00	30.50
CO_2	3.00	3.00	6.50
H_2	2.30	2.50	2.00
	100.00	100.00	100.00

The appearance of the layers of carbide which formed on the electro-iron was idential with that of the completely carburized plate. It was, after thorough cleaning, found to be pure carbide of iron, as was proved by an analysis which yielded 93.23 per cent of iron and 6.67 per cent of carbon. The center of the electrolytic iron, after exposure for a fortnight, contained intercrystalline deposits of pure carbide. In the specimen exposed for one month, the central parts still contained crystals of iron, as in the previous example, surrounded by envelopes of carbide, and in addition, carbide plates between the cleavages of the iron crystals. These results suggest that the carburizing gas passed most readily between the crystals, and less readily along the cleavages.

In other trials with electro-iron, in addition to the marked carburization, many of the strips, after exposure to the gases, were thickly coated with a layer of pulverulent matter, remarkable for the large quantity of ferrous sulphide it contained. Analysis of this material showed 14.40 per cent of sulphur and 23.00 per cent of iron. In one instance a strip, after exposure to the gases for 17 days together with a strip of platinum, was covered with a deposit, which was removed in three portions, including an outer layer of dust, a middle portion, and a lower deposit. The third deposit was moderately hard, and was removed by scraping with a spatula. As soon as it was detached a hard black skin was found adhering close to the iron, which began to curl up and flake off, obviously indicating a chemical change produced by the action of the atmosphere. The quantity obtainable was very small, but sufficient for the determination of the iron and total sulphur. It contained 40.00 per cent of iron and 18.3 per cent of sulphur. All the sulphur was present as sulphide. A little free carbon and a fair amount of manganese occurred in the specimen, which was also strongly magnetic.

The deposit just above the hard skin contained 14.55 per cent sulphur as sulphide. The layer above this contained about 7.0 per cent sulphur, practically all as a sulphate, while the outside portion contained 3.70 per cent sulphur as sulphate. The platinum strip was covered with dust, but this deposit was free from sulphur.

These interesting observations led to the conclusion that the sulphides found on the iron must have been produced by the action of sulphur contained in the gases, on the iron, but in what state the sulphur existed in the gases has not yet been determined. It is highly probable, however, that it was sulphur vapor. The sulphates on the outer layer must have been produced by oxidation after the strips were removed from the flues and exposed to the air.

A similar carburizing action to that already described was also noticed in the case of a steel ladder which was fixed inside a dust catcher in such a position as to be exposed to the hot gases and dust for about seven months. A specimen of this material became carburized to a considerable extent. An average analysis of the whole substance gave the following results:

	Per Cent
Combined carbon	3.44
Graphitic carbon	trace
Silicon	0.09
Sulphur	0.70
Phosphorus	0.03
Manganese	0.29

A similar result to the above was obtained by exposing a bar of iron for a month in the flue of a blast furnace making ferro-manganese. The temperature varied between 550 degrees Cent. and 650 degrees Cent. The bar was originally ¾-inch by ¼-inch in section. The analysis of the bar before and after treatment was as follows:

	Before Treatment. Per Cent.	After Treatment— Porous Envelope. Per Cent.	After Treatment— Central Part. Per Cent.
Combined carbon	0.020	6.6	1.5
Graphite	nil	...	...
Manganese	0.008	...	...
Silicon	nil	...	...
Sulphur	0.021	...	...
Phosphorus	0.008	...	...

The Shenango Furnace Co., Pittsburgh, has issued an illustrated booklet showing in tabular form the analyses of the non-bessemer and bessemer ores taken from the Mesabi range and the silicious ores from the Menominee range. Pictures of the company's furnaces at Sharpsville, Pa., and ore freighters are shown.

Asks Aid to Defeat Tavenner Bill

Leading Engineer Tells Plainly the Dangers of Latest Attack by Congress on Scientific Management—Urges Delay Until Impartial Investigation is Made

BY WILLIAM KENT

CONGRESSMAN Clyde H. Tavenner, of Illinois, one of the leaders of the anti-preparedness faction in the house of representatives, has introduced a bill (H.R. 8665) "to regulate the method of directing the work of government employes" making it "unlawful for any officer, manager, superintendent, or foreman, or other person having charge of the work of any employe of the United States government, to make or cause to be made with a stop watch or other time-measuring device, a time study of any job of such employe between the starting and completion thereof, or of the movements of any such employe while engaged upon such work. No premium or bonus or cash reward shall be paid to any employe in addition to his regular wages, except for suggestions resulting in improvement or economy in the operation of any government plant." Violation of this act is made a misdemeanor punishable by a fine of not more than $500 or imprisonment of not more than six months."

The alleged reasons for the passage of this act are stated in four "whereases" in its preamble. We quote: "A stop watch is used . . . . to ascertain the maximum amount of work possible for the most capable man in a given time and making this the 'standard time' in which work must be done, and by a system of premiums and bonuses, together with disciplinary measures sufficiently severe to enforce the system, this 'standard time' is the speed to which all workmen must eventually obtain if they are to retain their employment."

"* * * * The tendency of so-called 'scientific management' through the above timing and bonus features will be to further aggravate the accident disabilities and mortality aforesaid and reduce the workman to a mere mechanical, instead of a social and moral, relation to his work, and moreover are unnecessary to secure adequate efficiency of labor."

Danger of Passage is Real

To the readers of *The Iron Trade Review* who are acquainted, many of them through personal experience, with scientific management, and who know that the statements quoted from the preamble are untrue and absurd, it may seem incredible that any such bill as the Tavenner bill could possibly be passed by congress. But there is a real danger either that it will be passed, or that it or some similar bill will be tacked as a "rider" on one or more of the appropriation bills, when these bills reach the conference committees of the senate and the house, and when there is no opportunity for considering or debating the merits of amendments.

Such was the method of passing the Dietrick amendment to the army appropriation bill in the last congress, making it illegal to employ scientific management in the Watertown and other arsenals on work done for the army. The rider passed the house, failed in the senate and was reinforced in the conference committee, and, without debate, in the rush of the last days of the session, was enacted into law.

The reason why there is danger that the Tavenner bill, or riders to appropriation bills, antagonistic to scientific management, may be passed, is that the most powerful lobby in this country, that of organized labor, is behind it. This bill, the Van Dyke bill, a bill which prohibits all time studies throughout the postal service, introduced at the same time as the Tavenner bill, and the Dietrick amendment passed by the last congress, are all part of a general attack which has been carried on for several years by organized labor on the general principle and on all of the details of the modern system of management.

The president of the International Association of Machinists, in circular No. 12, April 26, 1911, addressed to the members of that association, said:

"* * * * The latest danger, and the one we propose to deal with in this letter, is the so-called Taylor system of scientific management. * * * * * The installation of the Taylor system throughout the country means one of two things, i. e., either the machinists will succeed in destroying the usefulness of this system through resistance, or it will mean the wiping out of our trade and organization with the accompanying low wages, life-destroying hard work, long hours and intolerable conditions generally." (Quoted from a paper by Miner Chipman, published in a bulletin of the Efficiency Society, New York, February, 1916.)

The labor leaders oppose scientific management because of their fear that its success means the wiping out of their organization. Their fear is baseless, for there is no reason why trade unions cannot exist alongside of scientific management, nor why, when the trade unions become more intelligent, there cannot be perfect harmony between the two. The leaders encourage the equally baseless fears of the workmen by telling them that scientific management will throw them out of their jobs, (the old fallacy that machinery decreases the demand for labor), that it means "speeding up", makes the workman a mere part of a machine, that it is brutal, "squeezes the last drop of blood out of him and casts him into the scrap heap."

Results of Investigations

A committee of investigations, headed by Prof. R. F. Hoxie, reports:

"It [scientific management] is to date the latest word in the sheer mechanics of production and inherently in line with the march of events. Our industries should adopt all methods which replace inaccuracy with accurate knowledge and which systematically operate to eliminate wastes."

Thus there is nothing in the conclusion from such investigations as have been made to indicate that the Tavenner bill ought to be passed, or that if it

William Kent

William Kent was born in Philadelphia, March 5, 1851. After serving as a clerk and bookkeeper, he entered Stevens Institute of Technology in 1874, as a special student, graduating in 1876. He then became editor of The American Manufacturer, and later superintendent of the open hearth department of Schoenberger & Co. For some years afterward, he was associated with the Babcock & Wilcox Co., and in 1890, opened an office in New York as a consulting engineer. He published in 1895 his Mechanical Engineers' Pocket Book, now in its ninth edition. He has been a member of the American Institute of Mining Engineers since 1876 and of the American Society of Mechanical Engineers since its organization in 1880. He was vice president of the latter society from 1888 to 1890. Mr. Kent was one of the first to appreciate the value of scientific management and his studies and contributions on that subject have done much to promote its adoption.

were passed, it would be of any benefit to workmen. Before such a bill should be passed there should be another investigation, made this time by a board of experts, representing both scientific management and labor, and it should last at least two years to be of any real value.

There is only one way to stop this iniquitous legislation. It is to educate the congressmen. Letters should immediately be sent in great number to both senate and house to show that public sentiment of intelligent men is aroused against the Tavenner bill and asking that it be defeated by an overwhelming vote, or else that it be postponed until after a thorough investigation of the whole subject is made.

The "Committee of Ten," W. Herman Greul, secretary, Eleventh avenue and Twenty-sixth street, New York, will be glad to receive from any one who writes to a congressman on the subject, the congressman's name, and preferably a carbon copy of the letter, and it will send to any one interested in the subject a small pamphlet, *A Call to Arms*, giving some views on scientific management which should be considered.

Theory Vs. Service

(A Communication to the Editor of *The Iron Trade Review*)

BY JOHN N. REMSEN

APPARENTLY, some trade journals regard large vested interests with most benevolent eyes. This statement is based on the fact that several trade journals have within the past 12 months printed several quite verbose reports of certain corrosion tests. To the uninitiated reader these tests have been presented in such clever fashion that they would appear (to the uninitiated) to be reports of actual research work made by actually disinterested parties and carried on for the uplift of the iron and steel industry.

A careful study of these reports by an initiated reader does, I think, throw a somewhat different light on this movement and would indicate a somewhat different purpose in the movement. In arriving at this interpretation, the initiated reader is aided greatly by his knowledge of the business affiliations of these disinterested observers. Such a reader finds that in all of these cases comparisons are shown which reflect on products manufactured and sold on established reputations by responsible and reputable manufacturers. The comparison being shown in competitions with products in which these disinterested observers have either permanent or temporary financial interest.

One particularly flagrant case is a recent article which purported to be an investigation into the vital subject of corrosion resistance. The chief author of that article is regularly employed by the company manufacturing the product, which is given a clean bill of health in this article. Furthermore, this particular author has within the past several years been engaged in work which can be classed rather in the realm of salesmanship and advertising than in the realm of research work; in fact, this gentleman has practically been occupied as a salesman rather than as a chemist or an engineer.

It is perfectly proper for any salesman, regardless of whether such salesman possesses the technical knowledge and education enjoyed by this gentleman, to advertise and exploit in every legitimate way the products manufactured by the company employing him. It is also true that proper allowance must be made for the overenthusiasm of any salesman, which might prompt him to boost his own product by an attempt to belittle the products of legitimate competitors. Such a salesman may be accused of possessing a peculiar and unfortunate code of business ethics, but cannot fairly be accused of anything worse.

What I feel is unfair, however, is the insertion of such advertising matter in the reading columns of reputable and influential trade journals and the publicity and incorrect interpretation given to such matter in such trade journals, aided by the editorial comment of these journals. Certain assumptions, founded largely on the natural bias of such salesmanic engineers, are apparently accepted by the editors of these trade journals as proof conclusive of the statements that this line of salesmanship is intended to convey to the public. It seems to me that it is open to question at least as to whether or not the proper place for such literature, in the columns of any reputable trade journal, is not some place where it is paid for at so much per line.

Why is it necessary at this late date to carry on theoretical tests under the personal direction of interested parties in order to prove or disprove the actual value of the iron products now before the buying public? And why, especially, is this necessary in the case of the products that this author praised and, by implication at least, condemned? Can it be because the decried products have behind them actual service records under actual service conditions and under actual observation of disinterested actual users that far antedates any possible service record that can be shown by the praised product? This condition being true for the simple reason that the praised product was not placed on the market until a number of years after the decried products had established an enviable reputation.

Certainly the wealth and prestige of a company manufacturing and exploiting the commended products should not influence the situation. Certainly no fair-minded editor (and I want to state right here that I believe that all the editors of all the trade journals are of this calibre) would allow himself to be influenced by such considerations.

Why is it then that tests such as the one that we have in mind—a test of specially prepared samples of the product manufactured by a company employing the chief author permanently and the assistant author temporarily, made in comparison with samples of competitive material purchased in the open market, carried on under the supervision of these financially interested observers—can by the widest stretch of imagination be considered as proving anything except the ability of the authors along certain lines of salesmanship? It seems to me, on the contrary, that they are definitely conclusive of only one thing, viz, that they were made for the purpose of boosting the product of the company employing these authors.

In refutation of the above, what actual disinterested observers are shown as having had an opportunity to check these results? What opportunity did the manufacturers of the competitive products have to find out if their material received fair play? Whoever before heard of any honestly made iron product of any kind disintegrating absolutely in 84 days? Granting, that the test was honest, how can such theoretical test under special conditions possibly compare with real service under the observation of disinterested, actual users?

I repeat that in my judgment the proper place for salesmanship and advertising in trade journals is in the advertising columns of such journals, over the name of the advertiser at the proper price per line.

Business News of Nation's Capital

Author of Tariff Commission Bill Discusses Its Provisions—Impressed by an Advertisement in The Iron Trade Review

Bureau of *The Iron Trade Review*,
206 Corcoran Bldg.,
Washington, D. C., April 25.

THE growing demand of the industrial world for the removal of the tariff from politics has been heard in Washington. The house ways and means committee, which initiates all matters relating to the tariff, appears to be thoroughly alive to the fact that industry has grown tired of constant political bickering over the tariff with the result that industry is kept in a state of apprehension merely to gratify the designs of politicians. There is, of course, a division of opinion as to whether it will be possible ever to remove the tariff from politics, either by the appointment of a non-partisan tariff commission, or in some other manner. There are many who think that the selection of such a commission would at least be a big factor toward separating politics and the tariff, and therefore is desirable. Others, perhaps a small minority, think the creation of a commission would surround the tariff with more politics than revolves about it now, if that is possible. Again, there are those who think the appointment of a non-partisan tariff commission would remove the tariff entirely from politics, and, among other proofs which they endeavor to cite, is the claim that in Germany and France, where there are tariff commissions, the tariff is not a political issue.

Representative Henry T. Rainey, of Illinois, ranking Democratic member of the ways and means committee, says that the tariff will be removed from politics entirely, if congress passes the non-partisan tariff bill which he has introduced and is known as an administration measure. Moreover, Mr. Rainey says the bill will be passed, and without a great deal of debate in either house or congress. He told *The Iron Trade Review* that the bill has been considered by the ways and means committee and that he expects it will be reported to the house the latter part of May. It will be part of the omnibus revenue measure which the committee is framing to raise funds necessary in connection with the administration preparedness program. This omnibus bill will also include an anti-dumping clause, perhaps along the line recommended by Secretary of Commerce Redfield, which, among other things, would make dumping of goods in America from foreign markets a method of unfair competition, to be prohibited the same as unfair methods of competition in domestic industry is prohibited by the federal trade commission act. It is also believed that the measure will carry the Hill dyestuff bill in a revised form.

"The tariff commission bill," said Mr. Rainey, "will not be the subject of caucus action by the Democrats. In that respect it is to be treated separately from the revenue legislation, for the latter will be subjected to the action of the Democratic caucus. This policy is to be pursued with regard to the tariff commission bill, so that it will be consistent with our determination that the commission bill will be strictly non-partisan. Democrats, like Republicans, will be left unpledged to vote as they see fit on the tariff commission legislation. I think it will be supported liberally by both parties, and that it will pass congress without a great deal of debate, although we invite a free discussion of the measure."

> Mr. Rainey was greatly interested in the two-page editorial —for that is what it was—carried in *The Iron Trade Review* last week by the Youngstown Sheet & Tube Co., advocating the creating of a non-partisan tariff commission. He asked for and was given a copy of *The Iron Trade Review* carrying the "editorial", and said that it was significant of the attitude of the business world generally.

"It is remarkable," said Mr. Rainey, "that business exists at all in the United States in view of the constant changes made in the tariff. Business interests have become thoroughly tired of having the tariff made a political issue. And why should it be a political issue any more than the question of internal revenue?"

Mr. Rainey spoke of the admirable way in which the tariff is handled by the commissions of Germany and France. Germany, he said, has not changed its tariff in 14 years, but will make another change next year and he indicated that this is one reason why this government should create a non-partisan commission as quickly as possible and get to work with a view to getting data upon which congress can build a tariff along intelligent lines. Changed economic conditions that will follow the world war is also assigned as another reason for taking up the question, but Mr. Rainey said that it is the plan to have the commission appoint the commission soon after the bill is passed and have it go to work at once. Its first work probably would relate to getting data from industries of the country with regard to the cost of production, and the many other items involved in the question of tariff-making. The commission will report to congress on the first day of December of each year the progress of its work, the power to fix rates, of course, resting with that body. Mr. Rainey said that the Neeley resolution, proposing an amendment to the constitution giving the commission authority to fix rates will not be given any serious consideration.

Asked why the non-partisan tariff commission bill prohibits the appointment as a member of the commission any person who has been elected to or served in the senate or the house of representaives, Mr. Rainey replied that that was another precautionary measure to keep the tariff out of politics. He said that one who has served as a member of congress might be influenced by obligations he had assumed. Mr. Rainey conceded that the commission would face some difficult tasks, among them that relating to a determination as to the cost of production, both in this country and abroad. One plant, he pointed out, may produce the same material as another at a much less cost because it is more efficient, or labor is cheaper, or because of some other reason. It was Mr. Rainey's opinion that if refusal were made by foreign producers to give data, retaliatory tariff legislation as applied to the foreign country involved could be enacted. Mr. Rainey, however, apparently did not think such a step would be necessary.

One objection made to the bill is that it does not give the commission the power of recommending rates.

Iron and Money: Fact and Comment

Wall Street Has Another Bad Week—Industrials Record Heavy Losses, Attributed to International Developments

INTERNATIONAL developments of the past week had a very depressing effect on the stock market. A rather remarkable feature of the general decline which took place was the fact that such companies as the Bethlehem Steel Co., which would naturally be benefited by contracts for munitions if the United States should go to war, recorded sharp losses, that of Bethlehem being 48½ points.

Bethlehem Steel dropped 44½ points early Monday, but closed with a net loss of only 10 points. The statement made by a Bethlehem official who has just returned from a trip abroad that not many more shell orders could be expected was responsible for some of the pessimism which prevailed.

The news from Washington that President Wilson had decided to address congress on the controversy with Germany was not received in New York until after the close of the stock market Tuesday. The day was marked by declines in war stocks and advances in other lines.

Wednesday, the day of the President's speech, was one of vigorous selling. Industrials which made declines of 4 points or more included Baldwin Locomotive, Lackawanna Steel, American Locomotive and American Coal Products.

Heavy selling continued Thursday. The New York City bond sale did not come up to expectations, but the prices realized were regarded as satisfactory, at 102,217 for the larger block of $39,593,900 and 101,417 for the $13,494,000 issue.

The stock exchange was closed on Good Friday, and on Saturday, the downward trend continued, the declines in industrials extending in some cases from 4 to 10 points. Declines of 5 points or more were numerous. The New York bank statement showed a loss in reserves amounting to $2,386,070.

Quotations at the close of business April 22 and changes in the leading stocks identified with the iron and steel industry for the week are shown in the following table:

	Close Apr. 22.	Net chg.
American Can	52½	—6½
American Can, prfd.	109	—3
Amer. Car & Fdy.	55½	—10¼
Amer. Car & Fdy., prfd.	116	— ¾
American Locomotive	63⅜	—8⅞
American Locomotive, prfd.	100	—1⅝
American Steel Foundries	44⅞	—5⅛
Baldwin Locomotive	86	—17⅞
Baldwin Locomotive, prfd.	108	— ½
Bethlehem Steel	420	—48½
Bethlehem Steel, prfd.	135	.....
Colorado Fuel & Iron	39½	—3⅜
Continental Can	81½	—1½
Crucible Steel	75	—23½
Crucible Steel, prfd.	112	.....
General Electric	159	—6
Inter. Harv. of N. J.	110¼	— ⅛
Inter. Harv. of N. J., prfd.	118	—1½
Internat'l Harv. Corp.	71	—2
Lackawanna Steel	65	—10
Nat'l Enam. & Stamp. Co.	19¾	—3¼
Pressed Steel Car	44	—6½
Pressed Steel Car, prfd.	101	—1
Pullman Palace Car	160¼	—1⅜
Republic Iron & Steel	43⅝	—6
Republic Iron & Steel, prfd.	107½	— ¾
U. S. Cast Iron Pipe & Fdy.	16⅞	—3⅝
U. S. C. I. P. & Fdy., prfd.	50¼	.....
United States Steel	80⅛	—4
United States Steel, prfd.	116¼	— ⅞
Westinghouse Mfg.	54	—8¾

The following table shows changes in maximum quotations of stocks not listed on the New York stock exchange:

	High Apr. 20.	High Apr. 14.
American Radiator	397	395
American Ship Building	45¼	46½
Cambria Steel	81¾	81¾
Chicago Pneumatic Tool	70⅜	73
Inland Steel	.....	.....
LaBelle Iron Works	53½	55⅛
Lake Superior Corpn.	10⅛	10½
Pennsylvania Steel	.....	80
Stewart-Warner Speed. Co.	86¼	86¼
Warwick Iron & Steel	10⅜	10¾
Westinghouse Air Brake	137	137½
Westinghouse Elec. & Mfg.	62¾	64¾

General Electric War Orders

According to the annual report of the General Electric Co., the value of orders received by that company for electrical apparatus and devices in the past year was $98,385,891, an increase of $14,637,370, or 17 per cent over those of 1914. This increase was largely due to the general revival of business in the latter part of the year. The report says these figures are exclusive of orders for special war munitions which have been so restricted as to interfere as little as possible with the regular product of the company. The percentage of profit from these orders will probably be less than that of the average of the company's output. The value of orders received for special war munitions during 1915 was $33,980,000. The amount of sales billed was $85,522,070.18, a decrease of $4,945,621.53, or 6 per cent. The sum of $3,607,991 was carried to surplus, which at the close of 1915 totaled $23,692,871.

The Atlas Powder Co., Trenton, N. J., has filed a certificate with the secretary of the state increasing its capital stock from $10,500,000 to $20,000,000 by the issue of $4,500,000 in preferred stock and $5,000,000 in the common stock. During the first three months of the year the company's gross sales amounted to $4,000,000.

Condition Improved

In making final awards to the receivers and others engaged in the administration, Judge Julius M. Mayer of the United States District Court, at New York City, announced that the affairs of the International Steam Pump Co. during the past year had been placed in a much improved condition. Covering the work done, the court said:

"Notwithstanding the depression immediately following the outbreak of the European war, the condition of the company has materially improved, owing to a combination of good management and better business opportunities, and it now goes into reorganization in much better shape than when its affairs were placed under the administration of the court."

The company obtained $6,350,000 worth of contracts for an entirely new class of work and within the past year the total volume of business exceeded $15,000,000, or $3,000,000 more than during any previous year in history. The average rate of profit was higher and the percentage of overhead expenses lower than the three years preceding the receivership.

Steel Trade After the War

Chairman John A. Topping, of the Republic Iron & Steel Co., referred to business conditions in the steel trade following the war in addressing the stockholders of the company at the annual meeting at Jersey City, April 19.

"Many anticipate a falling off in exports when the war ends," said Mr. Topping. "Those countries now at war, as a result of impoverishment, and inasmuch as they produce steel, will produce their own steel. There will be an outside demand, however, from Canada, South America, Africa and other countries that will need it, and we can expect a share in that business."

Mr. Topping outlined the rapid development that the Republic Iron &

Steel Co. had made in recent years. "A few years ago, we produced only 250,000 tons, annually, and now we are turning out 1,250,000 tons. Ten years ago, we produced 600,000 tons of iron and practically no steel, while now we are producing no iron and all steel.

"Steel is being produced now cheaper than ever before. When my administration came into office, we had a small output of coke. We bought large quantities of ammonia, iron ore and pig iron. Today, with all these, we are self-contained. We sell more iron ore now than we can use.

"In making coke we now produce as by-products tar, ammonia and others. We have cut down our use of coal 20,000 tons a month."

Since the company's annual report was issued, the company's business has realized all expectations of improvement, Mr. Topping said. The retiring directors, G. Watson French, Thomas J. Bray and Harry L. Rownd, were re-elected and subsequently the old officers were re-elected.

Lemoine Explains

President E. R. Lemoine, of the United States Cast Iron Pipe & Foundry Co., addressing the stockholders at the annual meeting, April 20, gave the reasons why his company had not engaged in the making of munitions.

"It would be as easy for us to manufacture sewing machines," said he, "as to manufacture shrapnel. We make cast iron products. Upon looking into the matter, we found that to manufacture war munitions, it would be necessary either to ask the stockholders to furnish money to equip plants for that business or divert our working capital from our regular business to a special business, which would not be good policy."

Mr. Lemoine stated that he took advantage of the low prices last year to purchase large tonnages of pig iron and other raw materials which would be sufficient for the company's requirements for a large part of the present year, but that later additional contracts would have to be placed.

Russians Are Negotiating

The Russian government is negotiating for the purchase of the Canadian Car & Foundry Co. plant at Fort William, Ont., which was completed in 1914, but never put in operation owing to the war. It contains all the machinery necessary for the manufacture of freight and passenger cars, and the Russian government will remove to Russia the entire equipment, valued at some $2,000,000. Before the deal can be completed an agreement must be arrived at with the city of Fort William, as the company is under bonds of $250,000 to operate there and employ a certain number of men. The company has expressed its willingness to rebuild and carry out its contract after the war. F. A. Skelton, secretary-treasurer of the company, has left for New York to meet the Russian agents and endeavor to close the transactions.

New Companies

Detroit, Mich., April 25. — These companies have filed articles of incorporation during the week: Star Wheel Corporation, Detroit, $50,000; Cadillac Tool Co., Cadillac, $15,000; Droford Starter Co., Detroit, $5,000; Detroit Bearing & Casting Co., Detroit, $110,000; Detroit Accessories Co., increased capitalization from $5,000 to $25,000; Walcott & Wood Machine Tool Co., name changed to Walcott Lathe Co., Jackson, decreased capitalization from $150,000 to $100,000.

Adding New Equipment

The George Oldham & Son Co., manufacturer of pneumatic tools and appliances, Frankford, Philadelphia, Pa., recently has purchased a complete equipment for a new power installation. Also, the upper floor of this company's present building now is being utilized and a large amount of new equipment is being installed. This will greatly increase the capacity of the plant, which is made necessary by the increasing demands for the company's product.

Will Meet in Cleveland

The annual meeting of the American Electro-Platers' Society, which was to have been held at Toronto, Ont., this year, but which will not be held in that place on account of the war, now is scheduled for Cleveland, with headquarters at the Hotel Statler, July 6, 7 and 8. A large number of interesting papers on plating and non-ferrous metallurgy will be presented. The Cleveland branch of this society is arranging a suitable entertainment program, which is in charge of Charles Werft, 1341 East 112th street, Cleveland.

Well Equipped

The Springfield, O., branch of the Gem City Machine Co., recently incorporated for $100,000 under the name of the Steel Products Engineering Co., has purchased a three and one-half story building at Dakota avenue and Columbia street. It has over 10,000 square feet of floor space, which it has equipped for making tools of all kinds and for doing contract manufacturing.

Many Members

Are Interested by the Joint Committee on Military Engineering

Actuated by a patriotic motive, the Chicago Elevated Railway system, through its president, Britten I. Budd, and the Peoples Gas Light & Coke Co., Chicago, through its vice president, E. J. Ward, have just subscribed for 25 memberships each on the Chicago joint committee on military engineering. These memberships will be given to employes of these concerns. Contributions from other corporations are looked for in the near future. From 25 founders the membership has jumped to over 200 and new applications are coming in daily.

The joint committee was founded less than three weeks ago by members of various technical organizations in Chicago, including the local branches of the four national engineering societies. The committee already has outlined a program consisting of a series of lectures by representatives of the corps of engineers of the United States army. Engineer officers of the national guard will conduct inspection trips bringing out the military phases of road building, bridge construction and sanitary engineering in military camps. Other phases of military engineering will be added to the program later.

The first lecture was given Thursday, April 20, by Lieut.-Col. W. V. Judson, Corps of Engineers, U. S. Army, Chicago, at the Hamilton club, Chicago.

Further particulars regarding the work of the joint committee may be had by addressing the secretary, Robert F. Hall, 111 West Washington street, Chicago, telephone, Franklin 1540.

Electrochemical Society

At the twenty-ninth annual meeting of the American Electrochemical Society, which will be held at the New Willard hotel in Washington, D. C., April 27 to 29, inclusive, the following papers of interest to the iron and steel industry will be presented: "The Rennerfelt Electric Arc Furnace," by C. H. Vom Baur; "Nickel Plating," by F. C. Mathers; "Electrolytic Zinc," by W. R. Ingalls; "Corrosion and the Engineer," by W. H. Walker; "The Effect of Rust Upon the Corrosion of Iron and Steel," by James Aston, and "A Review of the Recent Progress in Electrolytic Iron," by O. W. Storey.

News of Employers and Employes

Many Advances in Wages, Some Following Strikes—Labor Conditions Being Discussed at N. M. T. A. Meeting

WAGE advances have been numerous during the past week. Some of these have followed strikes, while others have been voluntarily granted by employers. Throughout the country there is a restless feeling among workingmen and very serious consideration is being given to the situation by employers. At the meeting of the National Metal Trades Association at the Hotel Astor, New York, Thursday and Friday of this week, there will be a free exchange of opinions on questions relating to labor.

Several additional plants in the Greater Pittsburgh district are affected by strikes declared during the last week or 10 days. Plants of the Westinghouse Electric & Mfg. Co., East Pittsburgh, were made practically idle last Saturday, when many machinists, toolmakers and other workmen refused to return to work. What appears to be a call for a general strike of union coal miners in the Pittsburgh district was issued by officers of the United Mine Workers of America, Saturday, when they asked miners of the Pittsburgh Coal Co. to suspend work until authorized to begin again, on the grounds that the company was not adhering to the wage agreement recently made in New York. Indications are that the dispute may be ended before the end of the week by mediation.

It is difficult to estimate the number of strikers at the Westinghouse plants, because many workmen have not been able to get into the plant, due to the activities of strikers on picket duty. To preclude the possibility of disorder and violence, saloons in East Pittsburgh have been closed temporarily. No formal demands have been made to officers of the company. On April 1, wages of employes were advanced about 10 per cent and no labor trouble had been expected.

M. C. Turpin, of the publicity department of the Westinghouse company, issued a statement, which in part follows:

"It is obvious that the strike is for an eight-hour day, but so far, the strikers have presented to the management no statement of their grievance nor has the grievance committee under consideration at present any such question of this kind."

That leading manufacturers in the Pittsburgh district vigorously oppose a reduction in working hours is clearly indicated by an advertisement appearing in the Pittsburgh papers today. More than 75 manufacturing concerns signed their names to this statement: "The undersigned, after due consideration, have unanimously decided that they will not reduce the working hours in their respective shops". Most of the concerns whose names are included in the list, operate foundries or machine shops. None of the larger steel manufacturers signed the statement, but it is known that the steel trade in general does not favor the eight-hour day.

Molders belonging to the union went on a strike Dec. 13, last, for an eight-hour day. This dispute has not been settled and it likely will die a natural death. Some foundries are operating in part and the situation gradually is becoming more normal.

President John P. White, of the United Mine Workers of America, has delegated William Diamond, statistician of the miners, to come to Pittsburgh in an effort to settle the dispute between the coal operators and miners. President White says that the miners "do not consider this a strike, but merely a suspension."

Will Award Prizes

The National Americanization Committee, 18 West Thirty-fourth street, New York City, has announced that it will award prizes amounting to $1,800 for plans for houses suitable for immigrants in industrial communities.

The committee in charge of this competition finds that most industrial communities of the country in which immigrants are a considerable percentage of the population are now characterized by separate quarters for foreign workers, with all kinds of makeshifts or otherwise unfit dwellings and distinctly un-American standards of living. This committee believes that these conditions are due largely to the fact that not enough attention has been paid to the subject, and that plans and suggestions have not been immediately available to meet the sudden and peculiar housing needs that result from the rapid clustering of towns around industries.

The purpose, therefore, of the competition is to produce good and economical plans for low-cost dwellings, which may be used as standard types in the work of the National Americanization committee in directing the attention of manufacturers, property owners and municipalities, to the importance of the problem and the factors constituting it, and to provide definite indications for the solution of the particular problems which may be presented.

Trouble in Canada

Toronto, April 25.—Labor troubles have been frequent of late in the munition factories of this city and Hamilton. A number of disputes and partial strikes have taken place, the men claiming that they were underpaid and forced to work overtime, Sundays and holidays at the ordinary rate of wages. The matter has been taken up by the Canadian government and an order-in-council has been issued, appointing a commission to make an investigation as to the labor conditions in Toronto and Hamilton munition plants. The commissioners named are, Judge Colin G. Snider, of the Wentworth Co.; Wm. Inglis, of the firm of John Inglis & Co., Toronto, and John McClelland, of Montreal, vice president of the International Association of Machinists. The inquiry will begin at once. The Hamilton machinists' union has presented to the employers a demand for increased pay and other concessions, asking for an answer by May 1, but in view of the action of the government it is understood that the question will be left in abeyance pending the report of the commission.

Wage Advances

Employes of the Youngstown Iron & Steel Co., Youngstown, O., excepting those working under an Amalgamated Association wage scale, will receive a 10 per cent advance in wages, to take effect May 1, according to President John O. Pew. The company has about 2,000 employes. This action follows closely upon the decision of the management of the Youngstown Sheet & Tube Co., the Republic Iron & Steel Co., and the Brier Hill Steel Co., all of Youngstown, to grant a 10 per cent advance. In all, about 30,000 men will be affected and the increase will approximate $2,500,000 a year, it is said.

The Carnegie Steel Co. has officially announced that it will pay common

labor 25 cents an hour in its Youngstown works commencing May 1. The rate as fixed by the 10 per cent increase in the other mills of Youngstown is 24 8/10 cents per hour.

The Sheet Metal Workers' Union, of Rockford, Ill., has secured an 8-hour day and wage increases to take effect May 1. The advances were secured through conferences with employers.

At Schenectady, N. Y., union laborers affiliated with the American Federation of Labor have secured increase from $1.888 to $2.40 without a strike.

Superintendent of waterworks John S. Lewis, at Youngstown, O., reports that the 8-hour statute governing municipal employment of laborers in Ohio is working a great hardship on Youngstown. He says it is almost impossible to get men to work for the city department, although they are paid 26¼ cents an hour as compared with 24.2 and 25 cents in the mills, because the city works them but eight hours a day, while in the mills they can work from 10 to 12 hours.

A raise of 10 per cent in the pay of all wage-earners in the employ of the Gillette Safety Razor Co., South Boston, Mass., effective April 20, is announced by the company. This raise affects about 800 operatives, and means the additional payment of about $40,000 a year.

A general advance of 10 per cent in wages, effective May 1, has been announced by the Lukens Iron & Steel Co. and the Worth Bros. Co., Coatesville, Pa., effecting about 5,000 men. Under the new rate, the laborers will receive 20 cents per hour. Some of the mills have been paying common labor 17½ cents per hour. The tonnage men also will participate in the readjustment of pay.

A new wage scale was announced Thursday by the Willys-Overland Co., Toledo, O., through a shop bulletin posted by Vice President H. L. Shepler. The shops of the company will be operated on an eight-hour day basis, and employes will receive at least 50 hours pay for the 48 hours work after June 1, when the new plan is to go into effect. The action was voluntary on the part of the company. Employes receiving 25 cents an hour or less will get an increase of 10 per cent of the present wage; those now receiving between 25 and 30 cents an hour will get a 7 per cent increase, and those now receiving more than 30 cents an hour will get a 4 per cent increase. The eight-hour day will go into effect June 1.

Most independent iron and steel manufacturers of the Greater Pittsburgh district have informed employes that wages will be advanced generally, May 1. Wage scales of the United States Steel Corporation, so far as possible, will be used as a standard.

Blast furnace workmen in the Mahoning and Shenango valleys have been notified of a wage advance to go into effect May 1. This wage advance notice includes all workmen employed at blast furnaces outside of the United States Steel Corporation whose employes had been notified previously of an advance effective May 1. The notice reads that the advance will be granted on the date mentioned, but the exact rate of increase has not been stated as yet officially, although it is understood to be 10 per cent. This general notice includes every independent stack at Youngstown, Struthers, Lowellville, Sharon, Sharpsville and West Middlesex, Pa. The Republic Iron & Steel Co. and the Youngstown Sheet & Tube Co. had previously posted notice of a wage advance to its blast furnace men and other employes effective May 1. It will be recalled that on Feb. 1, a like wage advance was granted blast furnace employes in both valleys.

Profit Sharing Ends

President James A. Campbell, of the Sheet & Tube company, stated last week that profit-sharing of his company's employes would cease as soon as the new wage scale became effective May 1. Men in the service of the company during the first four months of the year will share profits at the end of the year for that period, if earnings warrant, he announces.

Trouble in New Jersey

Labor troubles rapidly are becoming of more serious proportions in a number of New Jersey manufacturing centers. At Bayonne, N. J., the Bergen Point Iron Works, despite a large amount of business on its books, has closed its plant, due to the ugly mood displayed by its men and the company will not reopen until the men show a more friendly attitude.

At Harrison, N. J., the Worthington plant of the International Steam Pump Co. has been closed, due to the extent to which the strike at this plant has interfered with the operation of certain departments. At the foundry of T. Shriever & Co., in Harrison, a threatened strike was averted when the company granted the demands of its workers for a shorter working schedule without reducing pay. Employes of the New Jersey Tube Works, Harrison, have held several meetings and a strike at this plant would not be a surprise.

At Passaic, N. J., employes of the Passaic Metal Ware Co. have gone on strike. The company offered to grant a nine-hour day and higher pay, but this offer was not satisfactory to the strikers. Several additional strikers have developed at textile plants in and around Passaic.

At Elizabeth, N. J., several hundred carpenters are formulating demands for an increase from $4 to $4.50 for an eight-hour day and the men expect to go out on strike May 1. At Bayway, N. J., employes of the Standard Oil Co. have asked for an increase of 20 per cent in wages.

Inquiry Begins

The royal commission appointed by the Canadian government at the request of the machinists to investigate conditions in the munitions factories in Toronto and Hamilton has commenced its sessions in Toronto. A number of employes gave evidence showing that the dissatisfaction among the men was over the rate of wages and the hours of work. They alleged that the employers had not adhered to an agreement for a 50-hour week and time-and-a-half pay for overtime. Officials of the Massey-Harris, Allis-Chalmers and Fairbanks-Morse companies testified, the general tenor of their evidence being that they preferred to deal with employes individually in preference to recognizing the scale fixed by the machinists' union. They did not believe the fixed minimum wage was practicable, and contended that the principle of offering premiums, to which exception had been taken, produced good results and increased the output.

Col. Frederick Nichols, of the Allis-Chalmers Co., said that the refusal to grant a nine-hour day was due to employers having made their investments in munitions equipment on a 10 hour basis.

Social Service

A special meeting of those interested in social service work of industrial concerns has been arranged to take place during the meeting of the National Conference of Charities and Corrections in Indianapolis next month. This meeting will be under the leadership of Miss Edith S. Reider, of the International Harvester Co., and there will be discussion on health insurance, industrial hygiene, the treatment of inebriates and the attitude of large employers toward alcoholism, the relationship of poor physical condition to dependency and other subjects.

MEN OF THE IRON TRADE

Who they are Where they are What they are doing

HARRY CHANNON has been elected president of the McMaster-Car Supply Co., 174 North Market street, Chicago. James A. Delaney was chosen vice president.

Charles E. Newell has been placed in charge of a branch office opened at 416 Citizens building, Cleveland, by the Hydraulic Press Manufacturing Co., Mt. Gilead, O.

Hartwell A. Taylor, sales manager of the Russell & Erwin division of the American Hardware Corporation, New Britain, Conn., has resigned to accept a position in New York City.

Frank S. Reitzel has been elected comptroller of the American Iron & Steel Mfg. Co., Lebanon, Pa., effective May 1. Mr. Reitzel has been comptroller of the Pennsylvania Steel Co.

O. G. Smith, formerly connected with the Platt Iron Works Co., Dayton, O., has been appointed district manager for the National Transit Pump & Machine Co., in charge of its new branch offices in the Marquette building, Chicago.

Fred W. McKee, assistant superintendent of the Hazelton furnace of the Republic Iron & Steel Co., Youngstown, has been appointed superintendent of Hall furnace of the company at Sharpsville, Pa.

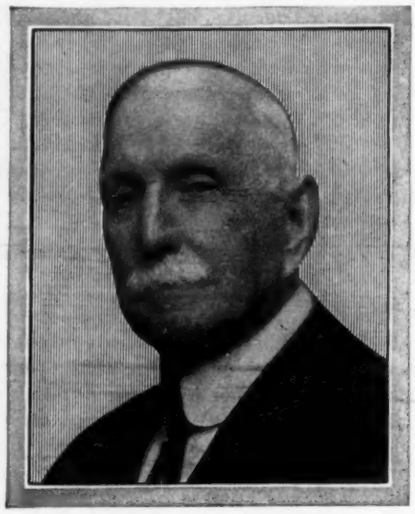
T. Rice Davis has disposed of his interest in the Vermillion Iron Co., Hoopeston, Ill., and has resigned his place as treasurer and general manager. C. L. Liebau, secretary of the company, has been appointed acting general manager in addition to his former duties.

Dixon C. Williams, just appointed postmaster of Chicago, is from the iron and steel trade. He is president of the Chicago Nipple Mfg. Co., manufacturers of wrought iron nipples and plumbing supplies, at 900 West Lake street. He came to Chicago in 1893.

B. A. Clements, who has been the western railroad representative of the Worth Bros. Co., at Chicago, has resigned and has become vice president of the Rome Merchant Iron Mills, Rome, N. Y., with headquarters at 30 Church street, New York City.

O. L. Remington, general manager for William McLean & Co., Melbourne, Australia, is in this country seeking to buy machine tools and similar material and to form trade connections with American makers. He is making his business headquarters at 3219 North Capital avenue, Indianapolis, Ind.

Clifford J. Ellis, who has been manager of the Chicago office of the Cambria Steel Co., has been made Chicago manager for Worth Bros., the Cambria Steel Co., and the Midvale Steel Co. New offices have been taken on the fourth floor of the McCormack building to care for the enlarged force made necessary by this triple alliance.



C. W. LEVALLEY,
Who Recently Resigned as President of Chain Belt Co., Milwaukee.

W. L. Schellenbach has opened an office at 520 First National Bank building, Cincinnati, as an expert machine tool designer and consulting engineer for industrial plants. Mr. Schellenbach has been connected with the machine tool industry in Cincinnati for a number of years, and is well known as the designer of the Schellenbach lathe.

Arthur W. Berresford, vice president and general manager, Cutler-Hammer Mfg. Co., Milwaukee, has been elected chairman of the Wisconsin board organized under federal supervision to prepare for the mobilization of industries in case of war. Other members of the board are: L. E. Strothman, Allis-Chalmers Mfg. Co., Milwaukee; F. W. O'Neil, Nordberg Mfg. Co., Milwaukee; Prof. D. W. Mead and Prof. C. F. Burgess, Madison, Wis. At the first meeting arrangements were also made to establish downtown headquarters in Milwaukee and place a paid secretary in charge. The chairman, Mr. Berresford, was born in Brooklyn, N. Y., in 1872, and is a graduate of Brooklyn Polytechnical Institute and Cornell University. He joined the Cutler-Hammer Mfg. Co. in Milwaukee in 1900. He is one of the best known electrical engineers in the United States.

J. Gilmore Fletcher, former president of the Riter-Conley Mfg. Co., Pittsburgh, which was recently taken over by the McClintic-Marshall Co., of that city, was tendered a dinner April 12 at the William Penn hotel by 45 officials, stockholders and employes of the Riter-Conley company. A complete silver table service was presented Mr. Fletcher by Joseph Riter, on behalf of the board of directors.

Frederick Clouston Moore has opened an office at 710 Engineers' building, Cleveland, to act in the capacity of a consulting and executive engineer. Mr. Moore will make a specialty of all matters pertaining to factory or foundry operation, organization, production, equipment, accounting and costs. He will also make special investigations and reports on new manufacturing projects, and on the financial, commercial and physical condition of established concerns, giving especial attention to industrial and engineering problems. He is a member of the American Society of Mechanical Engineers and the Society of Automobile Engineers.

Many Represented

Plans for a concerted demand for an 8-hour day in shops in Ohio were main topics for discussion at a meeting of the machinists' leaders in Cincinnati last week. In the campaign under contemplation more than 75,000 machinists and machine shop employes may be affected. Attending the meeting were union leaders from Cincinnati, Hamilton, Dayton, Piqua, Springfield, Columbus, Sidney, Lima, Urbana, Wapakoneta and Marion. George Richardson, Dayton, international vice president, presided. A meeting will be held in Hamilton in the next two weeks, it was announced.

Modern By-Product Coke Practice

An Account of the Obstacles Surmounted in Developing the Coke Oven of Today—How Benzol is Recovered—Growth of By-Product Industry

BY T. C. CLARKE

THE production of coke was first mentioned by the Greek philosopher Theophrastus, who was born 372 B. C. We know that in the middle ages coke was used in the arts. The records show that during the eighteenth century tars and oils were recovered from coal and it was known that a combustible gas was formed from coking coal. In 1825 we find the first record of beehive coke being made in Europe in any commercial quantities and in 1840 this country's first beehive coke ovens are said to have been built. In 1894, the first by-product coke plants were built in the United States. In round numbers, the production of beehive coke in 1894 in the United States was 9,187,000 tons and the by-product production was 16,500 tons. In 1900 the beehive production had increased to 19,457,000 tons and the by-product to 1,075,000 tons. In 1905 these figures had been increased to 28,768,000 tons and 3,462,000 tons, respectively. In 1910 beehive coke produced was 34,570,000 tons and by-product 7,138,000 tons. In 1913 the by-product ovens produced 12,714,000 tons. By the end of 1917, if all the ovens now built and building are in operation, the total by-product coke produced will be 24,000,000 tons, or within 10,000,000 tons of the record year's production of beehive coke in 1910, proving conclusiyely that the by-product coke oven industry has come into its own.

Number of By-Product Ovens

The number of beehive ovens in operative condition in 1894 is given as about 30,000, against by-product ovens of about 40. In 1910 the high water mark in beehive ovens was reached, the total number being a little more than 100,000. Today the number of beehive ovens is reduced to about 95,000, while the by-product ovens now total 8,677, more than 1,000 of that number being under construction.

Advance in pig iron production during this period shows equally remarkable increases. In 1894, the production of pig iron in the United States was 6,657,000 long tons; in 1900, 13,789,000 tons; in 1905, 22,992,000 tons; in 1910, 27,303,000 tons. The biggest year the country has known up to this year was 1913, when the production of pig iron was 30,966,000 tons. During that year the world's production of pig iron was a little more than 78,000,000 tons, of which Germany and Great Britain together contributed 29,185,000 tons. Thus of the 78,000,000 tons produced in the world, the United States, Germany and Great Britain contributed more than 59,000,000 tons. I give these figures because coke production was so closely related to pig iron production that the pig iron statistics of the world are in direct ratio to the coke production. Later I will show you that this ratio now is rapidly changing.

The average price at Connellsville for coke during this period was: 1894, $1; 1900, $2.70; 1905, $2.26; 1910, $2.10; 1913, $2.95. The market today is about $3 at the ovens. An average of the past 10 years shows the price to have been $2.23 at the ovens with freight added to destination.

The remarkable growth shown by these figures enables us to understand readily why the steel trade is called the barometer of the country's prosperity. But why the by-product coke industry in this country grew so slowly at first, although its economic advantages were so apparent, can be understood only by those who followed its early history.

Causes of Slow Initial Growth

Ovens as built originally in this country were from German plans and specifications and no consideration was given to the difference in the coking quality and analysis of the coals. In fact, beyond sending a few samples of coal to be coked in Germany, no attention was paid to existing conditions. The attempt was made to adapt the coals themselves to the ovens rather than the ovens to the coals. In order to be fair, it must also be taken into consideration that the first cost of by-product coke ovens was very high as compared to beehive ovens. In addition, violent fluctuations in the coke market seemed to promise periodical shutdowns of indefinite duration when earnings from the investment would cease. Furthermore, blast furnace superintendents, feeling that in the Connellsville coke they had an ideal fuel, threw the weight of their influence against the innovation.

Those who, like myself, were fortunate enough to be in charge of by-product coke ovens at that time, were impressed by the usual economic differences between foreign and American practice. Cheap labor permitted the German practice of from 28 to 36 hours coking time with a four to five-ton capacity oven, but American conditions pointed to greater economy, if the coking time could be reduced and the capacity increased. To do that, however, required the entire redesigning of the ovens.

From 1900 to 1906 tentative experiments were made. Although nothing was accomplished, well-defined theories were evolved that proved helpful during the later period of reconstruction. I shudder to think of some of the costly repairs made necessary by our misguided zeal in trying to improve the coking time. We melted regenerators and walls in pursuit of scientific data. With the assistance of stack drafts and ex-

The By-Product Coke Oven Industry

The relation between the iron and steel and by-product coke oven industries has been steadily growing more intimate. The economic advantages of the by-product coke oven were obscured for some years by various factors which the author points out in the accompanying article. The great increase in the number of by-product ovens in the past few years, however, is proof of the success with which these difficulties were overcome.

The European war has given an irresistible impetus to the by-product coke oven industry, largely through the enhanced profits realized from the recovery of benzol. Of almost equal importance is the glaring need, revealed by the war, for a self-contained American chemical industry, in which by-product coke ovens play a leading part.

Mr. Clarke, therefore, in the accompanying paper discuses a subject of more than usual interest to iron and steel manufacturers. Mr. Clarke's opportunities for gaining a deep insight into by-product coke oven practice, were unusually favorable. He was formerly associated with the Lackawanna Steel Co. and the Lehigh Coal Co. He is now a consulting engineer at 111 Broadway, New York. The paper was read before the Society of Chemical Industry, New York, April 21.

hausters, we tried experiments with flues and gas burners designed for 24-hour operation and managed to cut the time. but our by-product yields were unrecognizable. The owners of the ovens suffered, but I think the results attained show that their suffering was not in vain.

To show what has resulted from all this work, perhaps a brief description of the operation of the ovens might be of value. As a general example, we will use a vertical flue oven with individual regenerators, as that type at present is the most common. The ovens are heated by burning gas in flues on either side of the oven. This gas comes through a general main and is distributed to each vertical flue, of which there are about 30, through a horizontal fire-brick main. The gas enters the flue through a fire-brick nozzle. The size of this nozzle varies with the location of the flue so as to regulate the admission of the gas and secure uniform distribution as the distance from the main increases.

The gas flowing up through the flue meets the preheated air from the regenerators and combustion begins to take place about a foot above the nozzles. The products of combustion then ascend to the horizontal flue and pass through that to the opposite half of the battery and then down through these flues and through the opposite half of the regenerator and off to the tank.

The gas regulation in each flue is controled by a damper brick placed where the vertical flue meets the horizontal flue. This damper brick distributes the products of combustion and prevents their short-circuiting through the nearest flues to the stack, following the lines of least resistance. Each regenerator has an air port which automatically opens and closes when reversal takes place. This occurs every half hour, that is, after the gas has burned up one-half the flues and down the other half, for half an hour, the operation is reversed.

Handling the Coal

The coal, as a rule, is dumped from the cars into three or more hoppers under the track. Where the amount of coal handled justifies it, such as more than 1,000,000 tons per annum, a car dumper is used. From there the coal goes up on belts through a breaker or crusher, or both, into the mixing bins. The best results in mixing have been obtained by having these bins automatically feed in the required proportions on a belt conveyor, which then runs directly to the larries, which stand on automatic recording scales, or else runs into a storage bin, from which the coal is drawn into the larries.

The ovens are charged from the top through four or more charging holes, the coal being conveyed to the ovens in electrically-driven larries, with conical sides that are self-cleaning. The charging holes are covered during operation by cast plates, which are lifted off while charging.

After the ovens are charged, a leveler is run through the leveling hole in the doors which are in place. This leveler is run across the full length of the oven half a dozen times, or until the coal in the oven is leveled. The valves to the mains are then opened and the coking operation commences.

When the coal has been coked, the pusher, which is a car containing a ram nearly as wide as the oven, is brought up, the doors lifted off, the coke pushed out either into a quenching car or onto a wharf, where it is quenched and taken to the coke-handling plant to be screened and sized.

Quenching the Coke

The present practice is to take away the coke in a quenching car to a quenching station, where through perforated pipes, water is played on it for a certain period of time. It is then removed to a wharf where it is left until all of the steam is driven off and where the unquenched coke can be quenched by a hose. In quenching coke it is very hard to entirely quench it without having the top coke water soaked, giving a high percentage of moisture.

In the past, a number of different ways were tried, such as pushing the coke in a pan and then lowering it into a tank of water. Another method was to push directly onto a wharf and quench there, but this caused clouds of steam to blow back into the oven. The necessity of keeping down the moisture of the coke, gradually evolved the present plan, since the same argument that applies to ash, applies to moisture, and irregular quantities of moisture going into the furnace cause fluctuations in fuel consumption. The moisture under present practice does not exceed 4 per cent.

Regularity in operation is of the greatest importance. Consequently a schedule is laid out for pushing the ovens, and each oven must come out when its turn is reached. Usually every other oven, or every third one, is pushed so that the cold coal charge going in will have a hot oven on either side. It has been found that the worst thing that can be done is to allow the coke to soak, as it is called, after it is coked. It is much better to push the coke when it is a little green than to have it over-coked.

With the present ability to regulate the gas and air by valves, the suction from the exhaustors being fixed, the temperature can be so regulated that any desired coking time may be secured. Cracking of the walls which permits air or gas to get into the ovens is practically a thing of the past, as are also the so-called cold spots. Access to the flues makes it easy to discover where the gas is failing to do its proper work and by changing nozzles or damper brick, control can be secured and the condition so remedied that cold spots are inexcusable.

After the coke has been properly quenched and there is no further danger of its catching fire in the bins, it is elevated by felt conveyors and put through a rotary screen with sufficient pitch and height of fall, depending on the hardness of the coke, to break it into the desired size. In the meantime, the breeze falls out through the holes in the screen and is taken to the boiler houses or wherever it is to be used. In commercial plants where the coke is sized for breeze, blast furnace coke, and for foundry uses, the coke before going through the rotary screen, passes over bars and down to selecting discs. The smaller coke for the blast furnaces is passed on between these discs while the larger coke is picked up by the discs and dropped to the foundry coke loading station.

The gas from the distillation is lead from the ovens through a main or mains to the by-product recovery buildings. Where gas of a high calorific value is desired, as for example where gas is used for lighting purposes, two mains are employed, the rich gas from the beginning of the operation being taken off in one main and the lean gas from the last of the operation in the other one.

Reclamation of Ammonia

The by-product recovery method up to a short time ago, was to cool the gas in condensers and pass it through a tar extractor. The ammonia was scrubbed out of the gas by passing it in an opposite direction from the water through water towers, filled with wooden slats. The resultant weak ammonia liquor was passed through a still with steam and milk of lime and the freed ammonia carried in the gases to lead-lined saturators filled with sulphuric acid where the salt was precipitated and dipped out by hand with copper ladles, centrifugally dried, bagged and shipped. The gas then passed through the benzol scrubbers and the surplus gas, amounting to 50 per cent or more, was available for power and lighting the remaining gas

being returned to heat the ovens. At the present time, the co-called ammonia-recovery process is employed almost universally. In the Koppers process, the gas leaving the ovens is first cooled to about 33 degrees Cent. This eliminates most of the tar. The ammonia liquor and the tar are separated by gravity, the liquor being treated as in the old process. The gas after passing through the tar extractors, is returned to a heater and heated to about 70 degrees Cent. and is then passed through the sulphuric acid saturators as before.

In the Otto process, the gas is cooled to about the dew point of steam by a tar spray. By not going to a lower temperature, the ammonia remains as vapor in the gas. While of course a little of the ammonia liquor does appear, it is said to be less than in the other processes. In this process on account of the gas being saturated with water vapor, the saturators are either equipped with steam coils or the gas is superheated. In German practice, and it is being adopted in American practice, napthalene extraction follows.

To recover the benzol, the gas as it comes from the saturators is cooled to about 24 degrees Cent. and then washed with what is known as straw oil. This is a petroleum oil with a specific gravity at 18 degrees Cent. of not more than 0.875. This oil must have a viscosity of not more than 92 seconds at 21 degrees Cent., using a Saybolt viscosimeter, it must yield no distillates below 285 degrees Cent. and it must not thicken in cooling to 4 degrees Cent. After washing, the benzolized oil, containing about 2.5 per cent of benzol and its homologues, is run to a light oil still. The oil enters the still at about 135 degrees Cent. The steam drives off the light oil vapors which pass over to a condenser and the wash oil is returned to be used again. From the condenser, the light oils pass over to a fractionating boiler still where 90 per cent benzol, toluol, etc., are secured. For chemically pure benzol and toluol, a further washing with acid and caustic soda is performed and that product again distilled. This briefly describes the recovery process.

To increase the size of the oven charge required a larger oven, which in turn required more heat and more heat required increased flue and gas area. The ramifications of this change are not only the larger ovens and improved methods of heating them but an increase in the size of take-off mains, cooling and recovery apparatus, pushers, quenching cars, coal and coke handling plants, mixing bins, etc. This is the problem that confronted the engineers in the coke business. It is to their credit that they overcame the difficulties arising from such a complete change, did it with very few mistakes and what they did, they did well.

About the time this was being done a new factor which was a tremendous force for good appeared in the appointment by the United States Steel Corporation of a committee to investigate the by-product coke industry. The committee went to Europe and its investigation was of the greatest value to the industry here. With minds trained to mechanical requirements, they saw that the larger oven was perfectly feasible and they selected for their first plant the Koppers type of oven. This was seven years ago and one battery built then has never been out of operation and is in first class physical condition today. In only one respect did they allow existing prejudices to influence them and that was in the matter of brick. In European practice the quartzite brick is universally used. The silica brick is standard in this country. It is more efficient in conductivity and the only problem it presented at the beginning was its expansion under high heats. Perhaps the difficulties of this problem will appeal more strongly to you when I say that at a modern plant, the bricks for one oven weigh about 129 tons. Of this tonnage, 15 tons are silica, 9-inch, 45 tons silica shapes, 52 tons clay 9-inch and 17 tons clay shapes,

List of By-Product Coke Ovens in the United States, Built or Building

Producers of Benzol Are Indicated in the Last Column

	Type.	No.	Benzol.
Amer. Steel & Wire Co., Cleveland	Koppers	180	Yes
Allegheny By-Product Coke Co., Glassport, Pa.	Otto	120	Yes
Brier Hill Steel Co., Youngstown, O.	Koppers	84	Yes
By-Product Coke Corp., S. Chicago, Ill.	Semet-Solvay	280	Yes
Cambria Steel Co., Johnstown, Pa.	Otto	372	Yes
Cambria Steel Co., Johnstown, Pa.	Koppers	92	Yes
Central Indiana Gas Co., Muncie, Ind.	Klonne	22	?
Citizens Gas Co., Indianapolis, Ind.	Otto	100	Yes.
Coal Products Co., Joliet, Ill.	Koppers	35	?
Coal Products Co., Joliet, Ill.	Wilputte	18	Yes
Central Iron & Coal Co., Tuscaloosa, Ala.	Semet-Solvay	60	Yes
Cleveland Furnace Co., Cleveland	Semet-Solvay	100	Yes
Chattanooga Gas Co., Chattanooga, Tenn.	Roberts	12	?
Carnegie Steel Co., Clairton, Pa.	Koppers	640	Yes
Colorado Fuel & Iron Co., Pueblo, Colo.	Koppers	120	Yes
Dover By-Prod. Coke Co., Canal Dover, O.	Roberts	24	Yes
Empire Coke Co., Geneva, N. Y.	Semet-Solvay	46	Yes
Gulf States Steel Co., Gadsden, Ala.	Koppers	37	Yes
Inland Steel Co., Indiana Harbor, Ind.	Koppers	86	Yes
Inland Steel Co., Indiana Harbor, Ind.	Koppers	44	Yes
Indiana Coke & Gas Co., Terre Haute, Ind.	Gas Mch.	30	?
Indiana Steel Co., Gary, Ind.	Koppers	560	Yes
Illinois Steel Co., Joliet, Ill.	Koppers	280	Yes
Kentucky Solvay Co., Ashland, Ky.	Semet-Solvay	108	Yes
Lehigh Coke Co., So. Bethlehem, Pa.	Didier	40	Yes
Lehigh Coke Co., So. Bethlehem, Pa.	Koppers	424	Yes
Laclede Gas & Light Co., St. Louis	Koppers	56	Yes
La Belle Iron Works, Follansbee, W. Va.	Koppers	94	Yes
Lackawanna Steel Co., Buffalo, N. Y.	Otto	188	Yes
Lackawanna Steel Co., Buffalo, N. Y.	Rothberg	280	Yes
Lackawanna Iron & Steel Co., Buffalo, N. Y.	Otto	232	Yes
Maryland Steel Co., Sparrows Point, Md.	Koppers	120	Yes
Minnesota Steel Co., Duluth, Minn.	Koppers	90	Yes
Michigan Alkali Co., Wyandotte, Mich.	Semet-Solvay	30	Yes
Milwaukee Coke & Gas Co., Milwaukee	Semet-Solvay	160	Yes
New Eng. Gas & Coke Co., Everett, Mass.	Otto	400	?
National Tube Co., Benwood, W. Va.	Semet-Solvay	120	Yes
Nat'l Stamp. & En. Co., Granite City, Ill.	Roberts	240	?
Niagara Coke Corporation, Buffalo, N. Y.	Otto	100	Yes
Northwestern Iron Co., Mayville, Wis.	Otto	72	Yes
North Shore Gas Co., Waukegan, Ill.	Semet-Solvay	13	No.
Pennsylvania Steel Co., Lebanon, Pa.	Semet-Solvay	120	Yes
Pennsylvania Steel Co., Steelton, Pa.	Semet-Solvay	40	Yes
Philadelphia Suburban Gas & Electric Co., Chester, Pa.	Semet-Solvay	40	Yes
River Furnace Co., Cleveland	Koppers	204	Yes
Republic Iron & Steel Co., Youngstown, O.	Koppers	142	Yes
Semet-Solvay Co., Dunbar, Pa.	Semet-Solvay	110	Yes
Solvay Process Co., Delray, Mich.	Semet-Solvay	175	Yes
Solvay Process Co., Syracuse, N. Y.	Semet-Solvay	40	Yes
Sharon Coke Co., Sharon, Pa.	Otto	212	Yes
So. Jersey C. E. & T. Co., Camden, N. J.	Otto	150	Yes
Seattle Lighting Co., Seattle, Wash.	Klonne	22	?
Seaboard By-Product Coke Co., Jersey City, N. J.	Koppers	110	Yes
Tenn. Coal, I. & R. R. Co., Ensley, Ala.	Semet-Solvay	240	Yes
Tenn. Coal, I. & R. R. Co., Fairfield, Ala.	Koppers	280	Yes
Toledo Furnace Co., Toledo, O.	Koppers	94	Yes
United Furnace Co., Canton, O.	Koppers	47	Yes
Union By-Product Coke Co., Buffalo, N. Y.	Roberts	66	Yes
West'n States Coke Co., St. Paul, Minn.	Koppers	55	Yes
Wickwire Steel Co., Buffalo, N. Y.	Semet-Solvay	60	Yes
Woodw'd Iron & Steel Co., Woodward, Ala.	Koppers	170	Yes
Youngstown Sheet & Tube Co., Youngstown, O.	Koppers	204	Yes
Zenith Furnace Co., Duluth, Minn.	Otto	65	Yes

or 60 tons of silica and 69 tons of clay in all. While all of this brick is not silica by any means, yet the allowances for expansion in a battery of 75 ovens present rather nice calculations.

The entrance into the market of the Steel Corporation which unquestionably was the largest buyer potentially of coke ovens, spurred every one in the coke oven business to the greatest efforts. The Corporation's work in the industry has been of the very greatest advantage to all and it has experimented continuously along lines which have benefited every one connected with coke ovens. The remarkable fuel economies in blast furnace practice today, I believe, can be attributed to the innovations it made.

It is an incontrovertible fact that up to a few years ago, the metallurgical advantages of by-product coke over beehive coke were unrecognized, and more thought was given to its direct economic aspect than to its value in metallurgy.

There is one feature that delayed the general adoption of the by-product oven in this country and for that we must blame our bankers. In Europe we know that the chemical and allied industries are looked upon as very attractive investments. In this country, our bankers are, or perhaps since the war I should say were, very slow to take up this kind of investment. Now I think we may say safely a different feeling exists among them. Were we not accustomed to having the mineral wealth of this country at our disposal, conservation would have demanded the installation of by-product ovens. Not only is there the direct loss of the nitrogen to the farmer and the valuable creosote oils for wood preservation, but even the coal itself is wasted to a startling extent in the old beehive oven. The yield of coke from a beehive oven is about 65 per cent and from a by-product oven with the same coal about 75 per cent. Carl A. Meissner, chairman of the coke committee of the United States Steel Corporation, in a very interesting paper read before the American Iron and Steel Institute at its meeting in May, 1913, gave the following figures; the net tons of Pocohontas coal required to produce 2,880,000 tons of coke per year in the case of the beehive oven are 4,800,000 and in the by-product, 3,512,000 or a saving per year of 1,288,000 tons of coal. Recalling the figures given previously of the beehive coke production of the United States, which in 1910 amounted to 34,570,000 tons and applying these figures to that scale, the useless wastage is amazing.

The metallurgical aspect of the situation brings conservation to our attention again. It was the custom of the coke producers of this country to put ovens as near the mines as possible. The coal was unmixed and while during bad times, it might have been a very good coke, during good times, almost anything was shipped and accepted. The specifications as to the physical requirements of coke was principally that it should be long-fingered, 48-hour coke, "Connellsville standard". Its chemical specification was that it should not contain over 12 per cent ash, 1.00 per cent sulphur and only in the case of the bessemer practice was the phosphorus defined. When the best of the coal was being mined this specification was easily met but with such tremendous demands on the coal fields as there has been in the past few years, it began to be difficult to meet.

A by-product coke oven located usually near the blast furnace, solved a great problem for the steelmakers. Coals were brought to the ovens and mixed. At first it was thought a fairly high volatile coal would not make metallurgical coke and various mixtures of high and low volatile were made, depending upon the individual's experience and convictions. Today however a volatile of 30 per cent and more is being made into excellent metallurgical coke in a number of places.

The mixing of coals developed the fact that even an inferior coke, if it was absolutely uniform, would show a fuel saving in the blast furnace. It was common practice to put in coke from perhaps two or three different operations. While the coke physically looked about the same, it could not, as a matter of fact, be counted on to be uniform, and in consequence the furnace was operating under varying conditions, a hard coke going in at one time and a soft coke at another. This obviously does not tend toward fuel economy. The charging of large and small pieces of beehive coke was usual, whereas today it is recognized that by crushing the coke to uniform size, while it increases the amount of the breeze, thereby lowering the yield, works wonders in a blast furnace. One of the Chicago blast furnace superintendents states that for every 0.1 per cent below 1.00 per cent sulphur in the coke, he will pay gladly a premium of 15 cents per ton. By selection of the coals to be mixed, the sulphur content can be lowered.

A second source of economy in furnace practice equally important is the ash. In a 400-ton blast furnace, 1.00 per cent of ash in the coke using a fuel consumption of pound per pound, would mean putting in the furnace four tons per day of a material costing $4 a ton which not only is not valuable but is positively detrimental. To flux this ash, stone must be added and to melt the ash, in the added fuel, the same cycle occurs until the negligible point is reached. This gives an idea of what may be saved by the elimination of ash and the substitution of carbon in its place in the fuel. In this item alone, selecting coal for its ash content justifies the added cost of better selection at the mine, cleaner mining, etc. Uniformity enters prominently into the calculations for with uniform by-product coke the furnace man burdens his furnace for a regular ash and sulphur content while with the fluctuations in the ash and sulphur of beehive unmixed coke, he has to burden his furnace to take care of the worst possible condition or else face furnace variations of operation. To put it another way, he has to burn unnecessary fuel, put in unnecessary limestone, all taking the place of desirable ore, to provide against the abnormal or else have a furnace running hot one day and cold the next with no certainty of product.

In the Chicago district the coke consumption per ton of pig iron has dropped from the old ratio of 2,240 pounds of coke to 2,240 pounds of pig iron to 1,800 pounds per ton of pig, and I was informed two weeks ago when in Chicago, that some furnaces there were running under 1,700 pounds. Again referring to the statistics previously given of a production in the United States of 30,000,000 tons of pig per year, a saving of 400 to 500 pounds of fuel per ton of pig, with the fuel costing in the neighborhood of $4.00 per ton, is conservation of coal and of money, and again shows what a great debt of gratitude we owe to the pioneers in this industry.

As uniformity is the keynote to good practice in a blast furnace, so is regularity to the by-product coke oven. The practice today is to run everything on schedule and to make the heats conform to that schedule. Of course, this is only posible now that the regulation of nozzles, dampers, gas and air, have been refined.

At first the gas nozzles used to carbon up, impeding the flow of gas and in consequence making "cold spots'. To correct this, the nozzles were changed at frequent intervals when they showed signs of carbonizing, but now the gas is cut off a moment or two before reversing, while the air is left on, and so the carbon is burned out. The pipes connected with a fire brick flue for the supply of gas have plugs at all their angles so that the plugs may be taken out and the pipes cleaned. Peep holes are put in across the top of the oven at every flue and through these the man in attendance can observe and regulate the condition of the gases burning in the flue.

(To be continued next week.)

Numerous Visits to Plants

Will be a Feature of Convention of American Foundrymen's Association—Eminent Men Will Speak at Banquet

To permit the foundrymen who attend the annual meeting of the American Foundrymen's Association and the American Institute of Metals, which will be held in Cleveland during the week of Sept. 11, to indulge in plant visitations to a greater extent than was possible at previous conventions where two or three sessions were held daily, it has been decided by the program committee of this organization to have one technical session per day, which will continue from 9:30 a. m. until the papers and discussions for that session have been disposed of, the hour of adjournment having been tentatively fixed at 1:00 p. m. This arrangement, it is believed, will meet with the hearty approval of all of the members of these societies, and it will enable them also to devote more time to the inspection of the exhibits of foundry supplies and equipment and machine tools, which will be held concurrently at the Cleveland coliseum. The conventions of these two societies will open one day earlier than formerly, the final session being held on Friday. The annual meeting of the American Foundrymen's Association, therefore, will continue for a period of five days, from Monday, Sept. 11 to Friday, Sept. 15, inclusive. The meetings of both the American Foundrymen's Association and the American Institute of Metals will be held at the Hotel Statler, which also will be the headquarters of these two societies, but the headquarters of the exhibitors will be at the Hollenden hotel.

The meetings of the American Foundrymen's Association and the American Institute of Metals will be opened on Monday morning with a joint session of both societies, and the program will include the address of welcome and response; the annual addresses of the presidents of the American Foundrymen's Association and the American Institute of Metals and the reports of the secretaries of these two organizations. In addition, the representatives of the American Foundrymen's Association on the joint conference board on the training of apprentices will present a report and the report of the committee on safety and sanitation also will be heard.

A joint technical session also will be held on Tuesday, the program being limited to three papers, which will constitute symposiums on the following subjects: "Waste Foundry Sand, Its Reclamation and Disposal", which will be discussed in various papers that will treat the topic from different viewpoints; "Results of the Closer Co-operation of the Enginer with the Foundry", as relating to the manufacture of aluminum and brass castings, cast iron, malleable cast iron and cast steel and "Proper Gating of Molds" for the manufacture of aluminum and brass bearings, cast iron, malleable iron and castings.

The annual business meeting of the American Foundrymen's Association will be held on Wednesday morning, Sept. 18, when officers will be elected and reports of the executive committee and the auditors will be heard. Also a report will be made by the special committee of five on the conferences which it held during the year that led up to the conduct of the exhibit under the auspices of the American Foundrymen's Association and the American Institute of Metals.

Three simultaneous sessions will be held on Thursday morning for the discussion, respectively, of gray iron, cast steel and malleable iron, while on Friday morning malleable iron and steel sessions will conclude the business of the convention. The program, as outlined, promises to be the best in the history of the American Foundrymen's Association, since the topics to be discussed are practical and relate to problems daily confronting the foundryman.

C. E. Hoyt, Lewis Institute, Chicago, exhibition manager, already has received a large number of applications for space and the indications are that the Cleveland coliseum, which affords a floor area of 60,000 square feet will be crowded to capacity. No assignments of space have yet been made, nor has a floor plan been prepared, although this will be done within the next few weeks, when requirements of the various exhibitors approximately will be known.

A meeting of Cleveland foundrymen shortly will be held for the purpose of appointing committees for the entertainment of visitors, to serve as guides in plant visitation and for the reception and entertainment of the ladies who will attend. It is probable that the annual banquet will be held at the Statler hotel on Thursday evening, Sept. 14. Negotiations now are being conducted to secure several speakers of national reputation to deliver addresses at the banquet.

The Combustion Engineering Corporation, 11 Broadway, New York, manufacturer of stokers and grates, announces its removal from the thirteenth floor at 11 Broadway, New York, to the eighth floor in the same building, where it will have more space than it now has. Within the past four years, the corporation has been compelled to expand its office space three times. It has added Cincinnati and Birmingham, Ala., to its list of out of town offices and expects to open an office in Atlanta, Ga., in the near future.

Pure Benzol

Is in Active Demand, But Prices Have Not Advanced

New York, April 25.—Pure benzol for delivery over the next 12 months largely from domestic buyers, continues in good demand. The tone of the market is stronger, but prices have not been lifted. Contracts have been placed freely at 70 cents per gallon at the plant of makers. The spot market still shows considerable resale offering, largely by users who are getting new consumptive capacity into operation later than they had expected. A wider range of prices is shown, as low as 70 cents per gallon having been done, while leading sellers ask 80 cents per gallon. Tuluol on contract shows a fair new demand and prices are firm at $4.50 per gallon. Solvent naphtha is well settled at quoted prices and is unchanged in demand.

With the end of the season at hand, the market on spot or nearby sulphate of ammonia continues softer. Prices are quoted 5 cents per 100 pounds less than a week ago. Some export business is moving and there is a moderate spot demand. Placing of contracts by fertilizer manufacturers for delivery over the next 12 months is about to begin, as estimates of the requirements of individual companies now are being prepared.

The current quotations per gallon at the maker's plant on leading coke oven by-products are as follows:

Pure benzol, spot	$0.70 to .80
Pure benzol, contract	.70
Tuluol, spot	4.75
Tuluol, contract	4.50
Solvent naptha, spot	.45 to .50
Solvent naptha, contract	.40 to .45

Sulphate of ammonia is $3.45 to $3.50 per 100 pounds at tidewater.

Company Organizes

Stockholders of the Gschwind Furnace Co., Youngstown, O., recently incorporated for $250,000, have organized and elected the following officers: W. W. Watson, president; Carl E. Gschwind, first vice president and general manager; Col. Charles F. Ritter second vice president; John J. Van Gorder, secretary and treasurer; Dwight Harrison, counsel. A committee was named to select a site for the proposed plant.

New Shell Contracts Looming Large

Tool Builders Expect Heavy Domestic Buying if Ammunition Contracts Materialize—Western Railroads Issue Huge Tool Lists

THE machine tool market in the east is featured by a smaller volume of business than was reported a week ago. Further buying of tools for export to France, England and Italy, and, particularly, Russia, has taken place. The latter country, it develops, has placed considerable business lately through the Allied Machinery Co., 120 Broadway, New York. The domestic activity continues to be featured by sales to several of the time-fuse makers, but this business is not of such proportions as previously reported. Some further business has been concluded with shellmakers, but this has been of a scattered nature. The trade expects, however, that more equipment of this character will be placed, since much interest is being expressed in the possible awards of new shell contracts. One broker in New York is canvassing a number of manufacturers, claiming to be authorized to dispose of a contract involving 5,000,000 6-inch shells for the British government. It is understood that the Midvale Steel & Ordnance Co. has taken some further munition business, but none of the details is available.

Railroad buying in the east is less active. The Philadelphia & Reading has asked for bids on a fair-sized list of equipment. The Baltimore & Ohio has put out inquiries for equipment for its Mont Clare, Md., shops; this road also has made some additional purchases. The Union Pacific has closed for a number of tools on which bids were taken several months ago. Several large transactions, involving miscellaneous equipment, are pending in the east. One concern has taken bids on several cranes, and it expects to buy without delay.

The following eastern concerns are extending their capacity: Bridgeport Metal Goods Co., Bridgeport, Conn.; D. & W. Fuse Co., Providence, R. I.; Textile Machinery Co., Philadelphia; Campbell Electric Mfg. Co., Lynn, Mass.; Nagle Steel Co., Pottstown, Pa.; Northwestern Brass & Aluminum Co., Rochester, N. Y.; General Electric Co., Schenectady, N. Y.; Central Machine Co., Philadelphia; Traylor Engineering & Mfg. Co., Allentown, Pa.; Enterprise Mfg. Co. of Pennsylvania, Philadelphia; Nathan Mfg. Co., New York, which will erect an injector plant at Flushing, L. I.; American Pin Co., Waterbury, Conn.; Lebanon Boiler Works, Lebanon, Pa.; Frog & Switch Mfg. Co., Carlisle, Pa.; Peelle Co., Brooklyn; Staten Island Ship Building Co., Staten Island, N. Y., and the Brown Engineering Co., Reading, Pa.

Chicago Market Busy with Railroad Lists

LARGE inquiries by railroads for machine tools and other shop equipment is the feature of the market in Chicago. This sort of inquiry has been coming out with increasing strength for the past month and at present no less than four important western railroads are seeking additional equipment. They are the Chicago, Burlington & Quincy, the Chicago & North-Western, the Union Pacific and the Illinois Central. The lists issued by these four carriers appear on page 956. Dealers find unusual demand for grinding machines and it is somewhat difficult now to fill requirements. One local dealer recently purchased several grinding machines along with some other second hand equipment and sold them before they were shipped to his warehouse. The general inquiry for machine tools of various types continues excellent and indicates that manufacturing concerns in general are adding to or replacing their shop equipment. An interesting feature is the prospective visit to this market of a buyer from Australia, who is in this country to buy equipment and to form connections to exploit the Australian market. Not much material is being bought in the west for export shipment. Canadian and European interests appear to have supplied their needs fairly well and are not anxious to acquire additional machines.

Foreign Business Falling Off in Pittsburgh

THE Pittsburgh market for machine tools and heavy rolling mill equipment reflects considerable activity. Inquiry for machinery for the domestic trade is constantly becoming heavier, but purchases of tools for the manufacture of war materials are falling off perceptibly. Strikes and threatened labor trouble at numerous plants engaged in filling contracts for shells appear to be responsible for the lull in this branch of the market. The Charleston Steel Co., Charleston, W. Va., has completed plans for the erection of a plant. Two Rennerfelt electric furnaces have been installed, and preliminary inquiries for other equipment have been sent out. The Trumbull Steel Co., Warren, O., is reported to have awarded contracts for rolling mill equipment for the manufacture of cold-rolled strip steel. The plant will have an annual capacity of about 25,000 tons. The Chattanooga Steel Co., Chattanooga, Tenn., has closed for practically all the equipment for its open hearth steel works.

Railroad List Interests Cleveland

THE only activity in the Cleveland machine tool market is that afforded by the list of requirements issued by the Indiana Harbor Belt railroad. This list was published in *The Iron Trade Review* April 20. These machines are being bought through the New York Central railroad, Cleveland, G. R. Ingersoll, purchasing agent. Local dealers are confining their attention largely to domestic business. While there are no spectacular individual inquiries in the local territory, the amount of business concluded during the last week or 10 days has been very satisfactory. The Niles-Bement-Pond Co. and the Pratt & Whitney Co., at present located at 244 Rockefeller building, Cleveland, will move to the first floor of the Perry-Payne building, 730 West Superior avenue, about May 1. These two concerns will occupy a ground area of about 40 x 120 feet, and a large part of this space will be devoted to a display of machine tools built by the two concerns.

Labor Situation Ignored by Cincinnati Builders

MACHINE tool manufacturers in Cincinnati are showing very little concern over the reported renewal of the strike of union machinists on May 1. Union leaders are reported to have decided that on the first of next month walkouts will be called in one or two shops situated near each other, in an effort to

Loading Pig Iron into Charging Boxes

Where Quality Begins

In the plant of The Central Steel Company, *quality* begins right in the open hearth stock yard with the selection of high grade pig iron purchased under rigid specifications covering chemical and physical requirements.

And the same extreme care is taken in *every* step in the manufacture of our products.

AGATHON STEELS

The word "AGATHON" which signifies "highest quality" was an inspiration to the Ancient Greeks. The old Greek sculptors, famous for their "Agathon" art, used great care in the selection of their rough stone.

We are no less careful in our choice of *raw materials*.

"AGATHON" Chrome Nickel
"AGATHON" Chrome Steel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steel
"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" Silico-Manganese
"AGATHON" High Carbon

THE CENTRAL STEEL COMPANY

MASSILLON, OHIO

Detroit Office: 326-27-28 Ford Bldg., F. Walter Guibert, District Representative
Cleveland Office: Hickox Bldg. - The Hamill-Hickox Co., District Representative

form a nucleus for broader operations. Employers, however, do not believe that enough men to handicap operations can be persuaded to leave their places. More men are actually employed in machine shops in Cincinnati at present than before the strike was called. It has been noted that deliveries are being maintained in a more satisfactory manner than at any time in the history of the machine tool industry in that city. The present working forces have been carefully chosen from among the younger workmen and from those machinists who have expressed a desire to remain at work rather than to go out on another strike. These men are expected to remain at their machines, despite any call of the union. The strike in Springfield, O., is handicapping several foundries and machine shops. At Columbus, O., demands have been made for shorter hours with the same pay. The situation at Hamilton, O., is quiet. Inquiry for machine tools continues to decline. Sales of lathes to European interests have fallen off considerably, and the majority of shipments today are being made to domestic users.

Among New England Factories

PORTLAND, ME.—The Accessories Corporation has been incorporated to make shock absorbers and automobiles; $50,000 capital stock; by Herbert I. Allen, Seth A. Moulton, Wallace E. Parsons, John T. Skolfield and Louie H. Oberreich, Indianapolis, Ind.

RUMFORD, ME.—Sears, Roebuck & Co., Chicago, will build a 2-story and basement paper mill at Rumford this summer.

MANCHESTER, N. H.—The city of Manchester will build a brick, stone and terra cotta fireproof, 5-story, 240 x 180-foot high school on Concord street to cost $500,000.

HARDWICK, VT.—The Eastern Vermont Public Utilities Corporation has been incorporated for water power development; $200,000 capital stock; by F. Monroe Dyer, New York, W. C. Clifford, Bethel, Vt., I. M. Frost, Rutland, Vt., Albert A. Daniell, West Danville, Vt., and E. F. Clark, Groton, Vt.

WINOOSKI, VT.—The American Woolen Co. has taken over the last of the Stevens machine shops and foundries.

AMESBURY, MASS.—W. J. Murphy Co. has let a contract for the erection of a new foundry.

ATTLEBORO, MASS.—R. Wolfenden & Sons will add several new buildings to their plant.

ATTLEBORO, MASS.—The Attleboro Gas Light Co. will add a gasometer to its plant to cost about $55,000.

BOSTON.—The T. A. Gillespie Co. was low bidder at $346,887.50 for building section J of the Dorchester tunnel, previously mentioned, which will be of reinforced concrete and structural steel, about 1,000 feet long.

CHARLESTOWN, MASS.—The Boston & Maine railroad has awarded a contract for a wood, 1-story, 40 x 750-foot freight house to replace that damaged by fire recently.

CHICOPEE FALLS, MASS. — The New England Westinghouse Co. has let a contract for the erection of a 1-story, 124 x 190-foot, dry kiln building, to cost $50,000.

HUDSON, MASS. — The Wottoquottoc Worsted Co. is contemplating the erection of a brick, 1-story, 75 x 180-foot addition to its plant.

LAWRENCE, MASS.—George E. Kunhardt will build a brick and steel, 5-story, 94 x 322-foot addition to his plant on Island street to cost $140,000.

SOUTH WINDHAM, MASS.—The Smith & Windham Co. will build a 60 x 85-foot foundry to cost about $25,000. Adolph Suck, 97 Arlington street, Hyde Park, Mass., is about to let the contract.

SPRINGFIELD, MASS.—The Morris Mfg. Co., incorporated with $250,000 capital to manufacture die-casting machines, of a type developed by Albert W. Morris of Springfield, will erect a factory in Springfield in the near future.

SPRINGFIELD, MASS.—The Flynt Building & Construction Co., Palmer, Mass., has been awarded a contract to build a brick and steel machinery exhibition building for the Eastern States Exposition Co. This is but one of a group of buildings to be erected this summer.

WATERTOWN, MASS.—The Walker & Pratt Mfg. Co., Boston, stove maker, will build a brick, 1-story, 52 x 92-foot office building at Dexter avenue and Cypress street.

WORCESTER, MASS.—The United Wholesale Grocery Co. will build a concrete 4-story warehouse to cost $35,000 at 133 Grafton street.

WORCESTER, MASS.—The Spencer Wire Co. has awarded a contract for a brick, mill construction, 3-story, 52 x 100-foot addition to its plant on Webster street.

WORCESTER, MASS. — The Norton Co. has let contracts for the erection of a 4-story, 202 x 224-foot emery-wheel building and a 2-story, 96 x 144-foot clay building.

EAST PROVIDENCE, R. I.—A. R. Slack will build a brick, 1-story, 38 x 60-foot machine shop and an 8 x 10-foot boiler house on Pawtucket avenue.

PAWTUCKET, R. I.—The Phillips Insulated Wire Co. has been authorized to increase its capital stock from time to time to an amount not exceeding $2,500,000.

PAWTUCKET, R. I.—The F. G. Rowley Co. has been awarded a contract to build a brick building for the Green & Daniels Mfg. Co., on Middle street to cost $10,000.

PROVIDENCE, R. I.—The Providence Dyeing & Bleaching Co. is erecting a 2-story, 100 x 160-foot office and storage building.

PROVIDENCE, R. I.—The Merchants Cold Storage & Warehouse Co. will build a reinforced concrete and brick, 6-story and basement 70 x 100-foot cold storage building between Kinsley and Harris avenues.

PROVIDENCE, R. I.—The Willemin Mfg. Co. has been incorporated to make rifles, tools and ammunition; $100,000 capital stock; by Thomas F. Cooney, Daniel H. Morrisey and John J. A. Cooney. A plant will be established in the city of Providence.

WESTERLY, R. I.—The George C. Moore Co. will build a brick, 2½-story addition to its mill on Beach street for a weave shed and warehouse.

BRIDGEPORT, CONN.—The Royal Equipment Co. has increased its capital stock from $50,000 to $100,000.

BRIDGEPORT, CONN. — The Bridgeport Metal Goods Co. has awarded a contract for a brick, 4-story, 60 x 157-foot factory at Pine and Cherry streets.

BRIDGEPORT, CONN.—Bids close May 6 for building the proposed Grand street bridge over Pequonnock river, removal of the old bridge and constructing a bridge at East Washington avenue over the same rvier.

BRIDGEPORT, CONN.—The Home Brewing Co. will build a brick and concrete, 2-story, 80 x 112-foot bottling plant and a 1-story, 40 x 112-foot garage to replace buildings on Hallam street recently damaged by fire.

BRIDGEPORT, CONN.—The plant of the Hitchcock Gas Engine Co., Seaview avenue, has been taken over by the Standard Oil Engine Co., a new corporation, and plans are under way for a general extension of the industry. The officers of the new company are: Sloan Danenhower, president; Frank I. Hitchcock, vice president; H. S. Beardsley, secretary and treasurer; Sloan Danenhower, Frank I. Hitchcock, R. H. M. Robinson, Richard A. Wright and H. S. Beardsley, directors.

CHESHIRE, CONN. — The Connecticut Brass Co. has let a contract for the erection of a 1-story, 38 x 140-foot and a 38 x 40-foot plant at West Cheshire.

DANBURY, CONN.—Plans are being figured for a brick or concrete and steel, 1-story, 170 x 240-foot addition to the plant of the Ball & Roller Bearing Co.

EAST BERLIN, CONN.—The plant of the Berlin Iron Bridge Co., owned by the United States Steel Corporation, which has been idle for several years, will be dismantled this summer and its materials used for bridge construction work in New England.

EAST HARTFORD, CONN.—Plans are being completed by Geo. Zunner, architect, 756 Main street, Hartford, for a 2-story and basement, 35 x 60-foot addition to the plant of Noble & Westbrook Mfg. Co.

HARTFORD, CONN.—E. Gross & Co., will build a brick, 4-story, 48 x 137-foot warehouse on Avon street.

HARTFORD, CONN.—Myer & Mendelsohn have awarded contract for a brick, mill construction, 4-story, 70 x 135-foot warehouse on Windsor avenue.

HARTFORD, CONN.—The Royal Typewriter Co. will build a brick, mill construction, 4 and 1-story, 200 x 300-foot factory on New Park avenue.

HARTFORD, CONN.—The Sterling Blower Co. will build a brick and steel, fireproof, 1-story, 32 x 180 and 42 x 130-foot addition to its plant on Windsor avenue for foundry purposes.

MERIDEN, CONN.—W. J. Cahill will build a brick, 2-story and basement, 65 x 102-foot storehouse.

NEW BRITAIN, CONN.—The C. A. Danberg Co. has been incorporated to conduct a brass foundry; $5,000 capital stock; by Emil Danberg, Charles A. Danberg and Jennie Danberg.

SEYMOUR, CONN. — The Humphreyville Mfg. Co. has filed a preliminary certificate of dissolution.

Crawford Ore from the Dean-Itasca Mine on the Mesabi Range

The ore is non-bessemer, of good coarse structure. Dean-Itasca mine shipments for 1915 were 486,374 tons, mostly since August 1. For 1916 they will be considerably greater.

A complete analysis of Crawford Ore from Dean-Itasca Mine in natural state and dried at 212° Fahr.

	Dried 212°	Natural
Iron	58.35	50.2451
Phosphorus	.065	.05597
Silica	6.03	5.1924
Manganese	1.00	.8611
Alumina	3.40	2.9277
Lime	.16	.1377
Magnesia	.12	.1033
Sulphur	.031	.0266
Volatile Matter	5.74	4.9427
Moisture	13.89	

Crawford Ore Guarantee for 1916, 51.50 Per Cent Iron, Natural

The output of this mine during 1916, together with our five other mines, gives us an unusually large tonnage.

We are now taking contracts for this ore and will be glad to figure on your requirements for the coming season.

THE TOD-STAMBAUGH COMPANY

Perry-Payne Building

CLEVELAND :: :: :: :: OHIO

Along the Middle Atlantic Seaboard

BROOKLYN, N. Y.—W. Scott, 1453 Fulton street, is about to build a 1-story, 31 x 95-foot factory, to cost $50,000.

BROOKLYN, N. Y.—The nickel and silver-plating plant of Reid Burns at 40 Withers street, was damaged by fire.

BROOKLYN, N. Y.—F. A. Teses, 505 Spencer street, expects to let contracts shortly for the erection of a 1-story, 40 x 60-foot smelting plant.

BROOKLYN, N. Y.—The Peelle Co., manufacturer of fire doors and elevator safety appliances, is building a 2-story, 57 x 200-foot factory at Stewart avenue and Harrison place. It will abandon its present plant on Chauncey street as soon as the new building is completed.

FLUSHING, L. I., N. Y.—Samuel Jocks, Washington and Union streets, will build a 1-story, 34 x 55-foot manufacturing and storage building.

FLUSHING, L. I., N. Y.—Eugene Schoen, architect, 106 East Nineteenth street, New York, has taken bids on the structural contracts for a large plant which will be devoted to the manufacture of injectors. The plant will consist of three factory buildings, each 59 x 326 feet; a 3-story, 40 x 127-foot warehouse, a 2-story, 42 x 84-foot garage and a 3-story, 50 x 110-foot administration building. The engineer working in connection with the architect is A. Brociner, 104 West Forty-second street, New York. The plant will be owned and operated by the Nathan Mfg. Co.

LONG ISLAND CITY, L. I., N. Y.—The National Sugar Refining Co. is taking bids on a 9-story, 70 x 156-foot factory addition to be built at a cost of $85,000.

LONG ISLAND CITY, L. I., N. Y.—Wm. Higginson, architect, 21 Park row, New York, is drawing plans for a 4-story, 80 x 230-foot factory to be erected in Long Island City at a cost of $250,000, by the Degnon Terminal & Realty Improvement Co., New York. The building will be occuiped as a metal bed factory by the Kindel Bed Co., 254 Norman avenue, Brooklyn. This project has been previously noted.

NEW YORK.—The iron working plant of H. Adoff, 2114 First avenue, was damaged by fire.

Machine Tool Requirements of Four Great Railroads

Throughout the United States there has been a persistent inquiry from the railroads for shop equipment. Nearly every large carrier has replaced or added to its shop facilities and the following lists are an excellent example of the magnitude of railroad buying.

Union Pacific Railroad

W. V. S. Thorne, Director of Purchases, New York City

Five 18-inch lathes
Two 16-inch lathes
One tool room lathe
Three 36-inch lathes
Two 24-inch lathes
Three stud lathes
Five 26-inch shapers
Three 42-inch boring mills
Three heavy pattern upright drills

Illinois Central Railroad

J. C. Kuhns, Purchasing Agent, Chicago

One locomotive frame slotter
One locomotive frame drill
One 6-foot radial drill
One 42-inch vertical lathe
One horizontal punch
One staybolt cutter
One 10-ton crane

Chicago, Burlington & Quincy Railroad

L. N. Hopkins, Purchasing Agent, Chicago

MOTOR-DRIVEN MACHINES

Two heavy-duty universal milling machines
One 2½ x 26-inch turret lathe
Three 8¼ x 36-inch turret lathes
Two 18-inch tool lathes
Two 24-inch engine lathes
One 16-inch portable engine lathe
One 28-inch heavy-duty engine lathe
Three 28-inch heavy-duty shapers
One 36-inch heavy-duty crank planer
Four heavy-duty upright drill presses
One 24-inch vertical turret lathe
One 42-inch vertical turret lathe
One heavy-pattern link radius grinder
One double-end shear with 15-inch throat
One automatic flue-cutting and scarfing machine

BELT-DRIVEN MACHINES

One 1½-inch triple-head bolt cutter
One 3,000-pound double-frame steam hammer
One 1,500-pound single-frame steam hammer
One serpentine shear
One single-end punch and shear

MISCELLANEOUS MACHINES

Two flue-welding machines to weld 2¼-inch flues
One 24-inch hinged molding machine with air turn-over attachment for brass work
Seven 220-volt, direct-current motors
Thirteen 440-volt, alternating-current motors.

Chicago & North Western Railroad

General Offices: 226 West Jackson Boulevard, Chicago

One high-speed bulldozer
One center-drive journal-turning lathe for 36-inch wheels
One 2-inch, motor-driven, double-head bolt cutter
One belt-driven emery wheel stand, 1¾-inch arbor for 18 and 3-inch wheels
One 32-inch, belt-driven, vertical drill press
One 2-inch, 6-spindle nut tapper
One 300-ton wheel press for 36-inch wheels
One single-head bolt cutter
Two double-head bolt cutters
Two triple-head bolt cutters
Three 24-inch crank shapers
Two 42-inch upright drill presses
Two 16-inch motor-driven lever drill preses
Three double emery wheel standards, ¾-inch arbors
One 48-inch double-head, belt-driven, 300-ton, hydraulic car wheel press
One 50-ton screw forcing press
One 30-ton screw forcing press
One 75-ton screw forcing press
One 14-inch power hack saw
Two 90-inch belt-driven wheel lathes
One 42-inch motor-driven truck wheel lathe
One portable engine lathe
One 20 x 20 x 24-inch crank planer
One 54 x 54 x 12-foot bed planer
One 36 x 36 x 10-foot bed planer
One universal milling machine
One 42-inch double-head boring and turning mill
One double-head, 50-inch bed boring mill
One 600-pound steam hammer
One combination punch and shear
One set power plate bending rolls
One flanging clamp
One valve boring bar
Ten various sized chucks

Bed Room Talks With

ROLLING MILL JIM

When you're in bed tearing off a little sleep and the old phone rings with the night superintendent on the other end telling you No. 3 stand is wrecked all from a broken roll, it makes you want to bite a chunk out of the bedstead, doesn't it. My bed used to be chewed up like a hitching post, but since I've been using Hubbard Rolls, I bought a new Mahogany bed and it aint got a mark on it. You don't hate a good night's sleep any more than I do, Well?

Good Night—

Rolling Mill Jim.

Hubbard Steel Foundry Co.

EAST CHICAGO, IND.

All Kinds of Iron and Steel Rolls and Steel Castings.

STATEN ISLAND, N. Y.—The Staten Island Ship Building Co. has let contracts for the erection of two additions to its plant.

TRENTON, N. J.—The Star Porcelain Co. has let a contract for a 3-story addition on Muirheid avenue.

WEST NUTLEY, N. J.—The American Analine Chemical Co. is having plans drawn by Moses, Pope & Messer, 366 Fifth avenue, New York, for a $25,000 addition to its chemical factory at West Nutley.

ALLENTOWN, PA.—The Traylor Engineering & Mfg. Co. has decided to increase its capacity by adding to the height of its present buildings. Contracts for the structural material have been let, as reported in last week's issue of *The Iron Trade Review*. The company also will erect a machine shop, 200 x 536 feet, a 4-story warehouse, 70 x 200 feet, a boiler house and one or two other buildings.

PHILADELPHIA.—The Orlando Grease Co., Wayne avenue and Berkley street, has let a contract for the erection of a factory building to cost $5,000.

PHILADELPHIA.—The Enterprise Mfg. Co. of Pennsylvania, Third and Dauphin streets, has been granted a permit for erecting a 1-story, 50 x 58-foot foundry.

PHILADELPHIA.—The Nitrogenous Chemical Co., Thirty-seventh and Tasker streets, is having plans revised by engineers Day & Zimmerman, 611 Chestnut street, for a 2-story, 85 x 100-foot chemical factory.

PHILADELPHIA.—The Atlas Ball Mfg. Co., Second and Glenwood avenues, has let a contract for the erection of a 1-story, 60 x 120-foot blacksmith shop.

PHILADELPHIA.—The General Mfg. Co., Thirtieth and market streets, has let a contract for the erection of a chemical factory at a cost of about $10,000.

PHILADELPHIA.—The John Illingworth Steel Co., Tacony and Lewis streets, has let a contract for the erection of a 1-story, 60 x 144 foot, heat-treatment building.

PHILADELPHIA.—Jas. F. Burns, 713 Cherry street, has let a contract for the erection of a 5-story, 37 x 81-foot building, to cost approximately $18,000, to be used for the manufacture of electrical supplies.

Activities in the Central States

CLEVELAND.—The Kuhlman Car Co. is about to let contracts for the steel for an extension to its plant.

EAST LIVERPOOL, O.—The Golding & Sons Co. plans to build a 1-story, 91 x 244-foot factory, to cost about $125,000. N. C. Owen & Co., architects, 449 Leader-News building, Cleveland, are preparing plans.

YOUNGSTOWN, O.—The Gschwind Furnace Co., recently incorporated, plans the erection of a plant. Ernest McGeorge, 854 Leader-News building, Cleveland, is preparing plans.

YOUNGSTOWN, O.—The Trussed Concrete Steel Co. plans numerous shop extensions and enlargement of plant. Hunter Construction Co., 407 Dollar Bank building, has been awarded a contract.

YOUNGSTOWN, O.—The city will soon receive bids for two 15,000,000-gallon electrically driven centrifugal pumps for filter bed water supply and for a 4,000,000-gallon pump for water wash. F. M. Lillie is city engineer.

ZANESVILLE, O.—The Griffith & Wedge Co. plans to enlarge its plant. C. B. Wedge is president of the company.

CHARLESTON, W. VA.—The Charleston Steel Co. has been incorporated to manufacture ingots and also a diversified line of finished products; $400,000 capital stock; by H. G. Scott, president; J. W. H. Hamilton, vice president; Isidore Schwabe, treasurer and Edward M. Burdette, secretary. The company plans to build a plant, to cost $125,000.

HUNTINGTON, W. VA.—John S. Farr, Sixteenth street and Second avenue, will build a 5-story, 50 x 175-foot warehouse.

PARKERSBURG, W. VA.—The Parkersburg Ice & Coal Co. plans to enlarge its plant and will equip a tri-pure water filtration plant.

WHEELING, W. VA.—The Marietta Mfg. Co., manufacturer of steamboat engines, plans the erection of a 100 x 260-foot, mill construction building, to cost $25,000. W. A. Windsor is president of the company.

NEW TRENTON, IND.—A steel truss bridge of three spans, each 170 feet long will be built over the Whitewater river, at a cost of $35,000. John U. Mueller, New Castle, Ind., is consulting engineer.

RICHMOND, IND.—A steel bridge will be built at south G street, at a cost of $120,000. John U. Mueller, New Castle, Ind., is consulting engineer.

CHICAGO.—F. V. Prather, architect, 20 West Jackson boulevard, is preparing plans for a theater and store building, 3 stories, 94 x 114 feet, to cost $85,000, for L. M. Johnson, care of the architect.

CHICAGO.—D. I. Davis & Co., engineers, 431 South Dearborn street, are taking bids on a cold storage warehouse, 14 stories, 80 x 160 feet, at North Dearborn and Kinzie streets, for the Central Storage Warehouse Co.

CHICAGO.—Pond & Pond, architects, 64 East Van Buren street, are preparing plans for a building for the Woman's Club, Mrs. K. K. Robbins, chairman, 410 Michigan avenue. The structure is to be 10 stories, 104 x 120 feet, to cost $600,000.

PEORIA, ILL.—Plans are in progress by I. F. Stern, engineer, 37 West Van Buren street, Chicago, for a reinforced concrete viaduct 1,100 feet long and 33 feet wide over railroad tracks at South Adams street.

SOUTH BELOIT, ILL.—The Warner Mfg. Co. has been incorporated; $10,000 capital stock; by A. P. Warner, James W. Menhall and A. B. Cadman.

DETROIT.—The Michigan Central railroad is taking bids on the structural contracts for large car shops to be erected at Jackson Junction, Mich., and Detroit.

CHILTON, WIS.—A contract will be made by May 1 for the construction of a waterworks system to cost $42,000.

ST. LOUIS, MO.—Plans are being prepared by Geo. B. Post, 101 Park avenue, New York, for a 22-story hotel. 130 x 140 feet, containing 800 rooms, to cost $3,000,000 for the Hotels Statler Co. E. M. Statler, president, Buffalo.

PERRY, IA.—The Iowa Railway & Light Co. will build a plant at Perry to cost $100,000.

McKINLEY, MINN.—Plans are being considered for a municipal waterworks pumping plant to cost $30,000.

Western and Intermountain Territory

WICHITA, KAS.—The Mid-Continent Tire Mfg. Co. has obtained plans for a 1-story plant, 280 x 450 feet, estimated to cost $250,000.

MANHATTAN, KAS.—Bids will be received until May 9 by the county commissioners at Manhattan for two steel spans, each 260 feet long, to cost $40,000.

REDFIELD, S. D.—The city of Redfield is planning to spend $75,000 for a municipal electric light, power and heat plant.

FOREST RIVER, N. D.—A. B. Field and associates are planning to build an electric light plant, costing $10,000.

BANCROFT, MONT.—The city is considering the proposition of issuing bonds for the construction of a $30,000 municipal light and power plant.

BOZEMAN, MONT.—The city of Bozeman has voted $235,000 in bonds with a view to establishing an additional water works system and $70,000 for sanitary and storm sewer bonds.

BUTTE, MONT.—It is reported that the Dupont Powder Co. will erect a powder plant near Butte, to cost $500,000. It is also reported that the company is contemplating the installation of a hydro-electric power and nitrogen plant on the Pend Oreille river, 11 miles north of Metaline Falls, Wash. W. S. Yearsley, Spokane, is interested in the project.

HELENA, MONT.—The Chicago, Milwaukee & St. Paul railroad has ordered the construction of the Choteau-Agawan branch, which embraces the relaying of steel on the Lewiston-Harlowton line and rehabilitating the Hilger line to Roy junction. It is thought that the road will extend its line from Grass Range to Winnett.

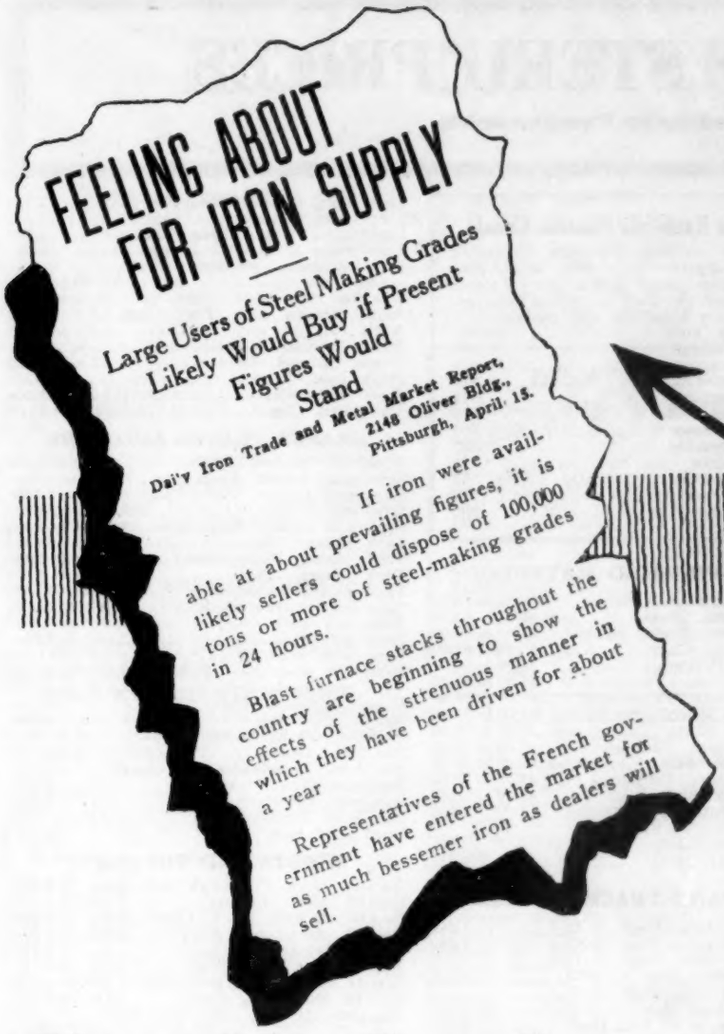
WHITEFISH, MONT.—Officials of the Great Northern railroad have taken up the question of the expenditures to be made at Whitefish. It has been announced that $60,000 has been authorized for the construction of new tracks and 15 additional stalls for the round house. Stationary boilers, pumps and air line are also to be constructed.

AMERICAN FALLS, IDA.—The Lead Bell Mining Co., with headquarters in Pocatello, is making arrangements to erect a concentrating plant on its ground with 150 tons capacity a day.

ENAVILLE, IDA.—The Consolidated Interstate-Callahan Co. is having plans prepared for a 1,000 or 1,200-ton concentrator to be erected on the 150-acre site recently purchased at Enaville at the junction of the Coeur d'Alene and North Fork rivers. W. T. Smith, Duluth, a large shareholder in the company, has made the announcement.

KELLOGG, IDA.—The Oregon-Washington Railroad & Navigation Co. will build a spur up to the Constitution mines, a distance of 10 miles.

KELLOGG, IDA.—Stanley Easton, manager of the Bunker Hill & Sullivan Mining Co., announces that Kellogg has been chosen as the site of the $1,000,000 plant to be built by the company. Construction work is to start at once. Sites at Portland and Puget Sound cities were under consideration for a time. The project has been previously noted in *The Iron Trade Review*.


FEELING ABOUT FOR IRON SUPPLY
Large Users of Steel Making Grades Likely Would Buy if Present Figures Would Stand
Daily Iron Trade and Metal Market Report, 2148 Oliver Bldg., Pittsburgh, April 15.
If iron were available at about prevailing figures, it is likely sellers could dispose of 100,000 tons or more of steel-making grades in 24 hours.
Blast furnace stacks throughout the country are beginning to show the effects of the strenuous manner in which they have been driven for about a year
Representatives of the French government have entered the market for as much bessemer iron as dealers will sell.

Every time the price of **Pig Iron** goes up, a great many foundries throughout the country wish that they had bought an abundant supply of it while the buying was still good.

Perhaps you yourself have been one of these unfortunate ones.

You Can Laugh at Increased Prices

if you have one or two Pig Iron Warrants stored away

These Pig Iron Warrants you can buy at a price lower than the price that pig iron is sold for on the open market.

And they are **always** GOOD, no matter how high "runaway" market prices may go.

Furthermore, besides this great protection in **price,** you are assured the additional protection which guards you against **shortage.**

The foundry with sufficient Pig Iron Warrants in its possession can always rely upon an unlimited amount of pig iron at a low price.

Will you take this proposition up with us so that we can explain its many advantages thoroughly?

Just tell us you wish full details

American Pig Iron Storage Warrant Co.

68 William St. **New York City**

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Lower price to July 1; higher to Jan. 1.)

Bessemer valley	$21.00 to 21.50
Bessemer, Pittsburgh	21.95 to 22.45
Basic, Pittsburgh	19.20
Basic, eastern Pa.	20.50 to 21.00
Basic, Buffalo	19.50 to 20.00
Malleable, Pittsburgh	19.45 to 19.95
Malleable foundry, Chicago	19.50
Malleable foundry, Philadelphia	21.50 to 21.75
Malleable foundry, Buffalo	19.00 to 20.00
No. 1X foundry, Philadelphia	21.00 to 21.50
No. 2 foundry, Pittsburgh	19.45 to 19.95
No. 2 foundry, Cleveland	19.30 to 19.80
No. 2 foundry, Ironton	18.50 to 19.00
No. 2 foundry, Chicago	19.00
No. 2X foundry, Philadelphia	20.50 to 21.00
No. 2X foundry, N. J. tidewater	20.50 to 21.00
No. 2X foundry, Buffalo	19.00 to 19.50
No. 2 plain, Philadelphia	20.00 to 20.50
No. 2 plain, N. J. tidewater	20.00 to 20.50
No. 2 plain, Buffalo	18.75 to 19.00
No. 2 southern, Birmingham	15.00 to 15.50
No. 2 southern, Cincinnati	17.90 to 18.40
No. 2 southern, Chicago	19.50 to 20.00
No. 2 southern, Phila. delivery	20.00 to 20.50
No. 2 southern, Cleveland	19.00 to 19.50
No. 2 southern, New York docks	19.00 to 19.50
No. 2 southern, Boston docks	19.25 to 19.75
No. 2 south. interior, New Eng.	20.00 to 21.00
No. 2 southern, St. Louis	18.40 to 18.90
Virginia No. 2X, furnace	18.50
Virginia 2X, Philadelphia	21.25
Virginia 2X, Jersey City	21.00
Virginia 2X, Boston points	21.75
Gray forge, eastern Pa.	19.00 to 19.50
Gray forge, Pittsburgh	18.95
Gray forge, Birmingham	14.00 to 15.00
Silveries, 8 per cent, furnace	29.00
Silveries, 8 per cent, Chicago	31.50
Low phos. Standard, Phila.	34.00 to 35.00
Low phos. Lebanon, Pa.	30.00 to 32.00
Low phos. Pittsburgh	30.00 to 31.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	19.75 to 22.25
Charcoal, Buffalo	21.00 to 22.00
Charcoal, Birmingham	23.00

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	$4.45
Mesabi Bessemer, 55 per cent, ton	4.20
Old range non-Bess., 51½ per cent, ton	3.70
Mesabi non-Bess., 51½ per cent, ton	3.55

Eastern Ores.
(Per unit delivered eastern Pennsylvania.)

Pt. Henry fur., 60 per cent, unit	8.5c to 8.9c
Local N. Y. and N. J. ores, unit	8.5c to 8.75c
Port Henry lump, at mines, ton	$4.00

Foreign Ores.
(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent	8 to 8½
For'n non-Bess., 50 to 65 per cent	8 to 8½

COKE

(At the ovens.)

Connellsville furnace (nom.)	$ 2.00 to 2.50
Connellsville fur., contract	2.90 to 3.00
Connellsville foundry, contract	3.50 to 3.75
Connellsville foundry	3.50 to 3.75
Wise county furnace, contract	3.00 to 3.25
Wise county foundry, contract	3.50 to 3.75
Pocahontas foundry, contract	3.25 to 3.75
Pocahontas furnace, contract	3.00 to 3.25
New River, foundry contract	3.75 to 4.25
New River, furnace contract	3.25 to 3.50

FERRO ALLOYS AND STEEL MAKING METALS

Ferro manganese, 80 per cent, seaboard, prompt	$400 to 450
Ferro manganese, 80 per cent, seaboard, contract	175
Spiegel, 20 per cent, furnace, prompt and 2nd quarter	80.00 to 100.00
Spiegel, 20 per cent, fur., last half	60.00 to 65.00
Ferro-silicon, 50 per cent, Phila.	83.00 to 85.00
Ferro-silicon, 50 per cent, Pbgh.	83.00 to 85.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $30.00; 10 to 11 per cent, $31.00; 11 to 12 per cent, $32.00; 12 to 13 per cent, $33.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive for insurance and dockage.

From New York	$0.40
From Pittsburgh	.619
From Youngstown	.619
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

SEMI-FINISHED MATERIAL

Open hearth billets, Phila	$50.00 to 55.00
Forging billets, Phila	60.00 to 65.00
Forging billets, Pbgh., nominal	65.00 to 70.00
Forging billets, Chgo	55.00 to 60.00
Wire rods, Pittsburgh (nom.)	55.00 to 60.00
Bessemer billets, Youngston	45.00 to 50.00
Bessemer billets, Pittsburgh	45.00 to 50.00
Open hearth billets, Pittsburgh	45.00 to 50.00
Open hearth billets, Youngstown	45.00 to 50.00
Bess. sheet bars, Youngstown	45.00 to 50.00
Op. h'th sheet bars, Youngstown	45.00 to 50.00
Bess. sheet bars, Pittsburgh	45.00 to 50.00
Open h'th sh. bars, Pbgh.	45.00 to 50.00
Muck bar, Pittsburgh (nominal)	40.00

SKELP

Grooved steel skelp	2.50c
Sheared steel skelp	2.75c

RAILS AND TRACK MATERIAL

Stand. Bess. rails, Pbgh. & Chg.	1.25c
Stan. op-h'th rails, Pbgh. & Chg.	1.34c
Stand. Bess. rails, Pbgh. & Chg. delivery after May 1, 1917	1.47½c
Stan. op-h'th rails, Pbgh. & Chg. delivery after May 1, 1917	1.56½c
Light rails, 8 to 10 lbs., Pbgh.	2.25c
Light rails, 8 lb., Chgo	1.95c
Light rails, 12 to 14 lbs., Pbgh.	2.20c
Light rails, 12 lbs., Chgo	1.90c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.25 to 1.60
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (r. and w.)	4.25
Philadelphia (all rail)	5.20
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to.—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$ .54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails, 16 to 20 lbs., Pbgh.	2.15c
Light rails, 16 to 20 lbs., Chgo.	1.85c
Light rails, 25 to 45 lbs., Pbgh.	2.10c
Light rails, 25 to 45 lbs., Chgo.	1.80c
Relaying rails, standard, Pbgh. and Chgo.	$23.00 to 24.00
Relaying rails, light, Chgo.	24.00 to 25.00
Angle bars, st. sect., Pbgh., base	1.50c to 1.75c
Angle bars, st. sections, Chgo.	1.50c to 1.75c
Spikes, railroad, Pbgh.	2.65c to 2.75c
Spikes, railroad, Chgo.	2.75c to 2.90c
Track bolts, Pbgh.	3.25c
Track bolts, Chgo.	3.25c to 3.50c
Tie plates, Chgo.	50.00 to 55.00

SHAPES, PLATES AND BARS

Structural shapes, Pbgh.	2.75c to 3.25c
Structural shapes, Pbgh. (con.)	2.50c to 2.75c
Structural shapes, Philadelphia	2.609c to 3.159c
Structural shapes, Chgo.	2.69c to 3.29c
Structural shapes, New York	2.669c to 3.169c
Tank plates, Chgo.	3.09c to 3.49c
Tank plates, Pbgh. (con.)	2.75c to 3.00c
Tank plates, Pbgh.	3.00c to 4.00c
Tank plates, Philadelphia	2.909c to 3.659c
Tank plates, New York	2.919c to 3.699c
Bars, soft steel, Chgo.	2.69c to 3.29c
Bars, soft steel, Pbgh. (con.)	2.50c to 2.75c
Bars, soft steel, Pbgh.	2.75c to 3.25c
Bars, soft steel, New York	2.669c to 3.169c
Bars, soft steel, Phila.	2.659c to 3.159c
Hoops, carloads, Pbgh.	2.75c
Bands, Pittsburgh	2.50c
Shafting, Pbgh., contr. carloads	10 to 20 off
Bar iron, Chgo	2.35c to 2.50c
Bar iron, Philadelphia	2.559c
Bar iron, New York	2.569c
Bar iron, Cleveland	2.25c
Bar iron, Pittsburgh	2.50c to 2.75c
Hard steel bars, Chgo.	2.75c

SHEETS AND TIN PLATE

No. 28, black Pittsburgh	2.90c to 3.00c
No. 28, black, Chicago	3.09c to 3.19c
No. 28, tin mill, black, Pbgh.	2.90c to 3.00c
No. 28, galvanized, Pbgh.	4.85c to 5.25c
No. 28, galvanized, Chgo.	5.19c
No. 10, blue anl'd, Pbgh.	3.00c to 3.10c
No. 10 blue anl'd, Philadelphia	3.659c to 4.159c
No. 10, blue anl'd, Chgo.	3.19c to 3.29c
Tin plate, 100 lb., coke base	$5.00

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single pickl'd, cold roll. and re-anld.	30 cents
Hot roll'd pickled and anl., tin mill.	25 cents
Full pickled, cold rolled and re-anld.	50 cents
Auto sheets	75 cents
Blue stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller leveling	10 cents
Patent leveling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxiding	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free fr. mill scale	55 cents
Special open hearth deep stpg. steel, free from mill scale	80 cents
Extra deep special auto body stock	1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents

No reduction for sheets not annealed.

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black. Butt.-weld.	Galv. Lap-weld.
Steel, ⅜ to 3 inches	70	50½
Iron, ⅜ to 1½ inches	60	38
Steel, 2½ to 6 inches	68	48½

BOILER TUBES

Steel, 3½ to 4½ inches, l. c. l.	56
Iron, 3½ to 4½ inches, l. c. l.	44

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotations.)

Wire nails, jobbers', Pittsburgh	$2.40 to 2.50
Plain wire, jobbers', Pittsburgh	2.25 to 2.35
Galvaniged wire, jobbers', Pbgh.	2.95 to 3.05
Polished staples, Pbgh.	2.55 to 2.65
Galvanized staples, Pbgh.	3.25 to 3.35
Barb wire, painted, jobbers', Pbgh.	2.55 to 2.65
Barb wire, galv., jobbers', Pbgh.	3.25 to 3.35

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ½ x 6 inches, smaller or shorter, rolled thread, 50, 10 and 5, cut threads 50 and 5; larger or longer, 40 and 5.

Machine bolts with hot pressed nuts, ½ x 4 inches, smaller or shorter, rolled 50, 10 and 10; cut, 50 and 10; larger or longer, 40, 10 and 5.

Cold pressed, semi-finished hexagon nuts, 60 and 10.

Gimlet and cone point lag bolts, 60. Hot pressed square, blank or tapped nuts, $2.90 off list; hot pressed hexagon blank or tapped, $2.90.

Cold pressed square, blank or tapped, $2.60 off; hexagon, blank or tapped, all sizes, $3.00.

RIVETS

Structural rivets, Pbgh	3.75c
Structural rivets, Chgo. delivery	3.30c
Boiler rivets, Pbgh	3.85c
Boiler rivets, Chgo. delivery	3.40c

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	2.50c

STANDARD STEEL CHAIN

Chain, ½ inch proof coil	5.00c

COLD ROLLED STRIP STEEL

Base price 6.00c to 6.25c per 100 pounds, hard, coils 1½ inches and wider and by .100 inches and heavier.

Extra for Thickness.

0.100-inch and thicker	Base
0.050 to 0.099	$0.05
0.036 to 0.049	0.20
0.035	0.20
0.031 to 0.034	0.35
0.026 to 0.030	0.45
0.020 to 0.024	0.55
0.025	0.45
0.017 to 0.019	1.35
0.015 to 0.016	1.75
0.013 to 0.014	2.45
0.012	2.80
0.011	3.15
0.010	3.50

Other extras as per card of March 15, 1916.

CAST IRON WATER PIPE

Four-inch, Chicago	$33.50 to 34.00
Six-inch and larger, Chicago	30.50 to 31.00
Six-inch Class B, New York	30.50
Four-inch, Class B, New York	33.50
Four to six-inch, Birmingham	28.00 to 29.00
Six-inch and larger, Birmingham	25.00 to 26.00

Light weight water and gas pipe $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	3.10c
Steel squares, 2-in. & ov., Cleve.	3.75c
Steel rounds, 2-in. & ov., Cleve.	3.75c
Steel bars, under 2 in., Cleveland	3.25c
Steel bars, Philadelphia	3.25c to 4.10c
Steel bars, New York	3.10c
Steel bars, St. Louis	3.15c
Steel bars, Cincinnati	3.20c to 3.75c
Steel bars, St. Paul	3.20c
Steel bars, over 2-inch, Buffalo	3.90c
Steel bars, Buffalo	3.20c
Iron bars, Chicago	3.10c
Iron bars, Cleveland	3.20c
Iron bars, St. Louis	2.75c
Iron bars, Cincinnati	3.20c to 3.75c
Iron bars, Philadelphia	3.00c to 3.25c
Iron bars, New York	3.10c
Shapes, Chgo.	3.10c
Shapes, St. Louis	3.15c
Shapes, St. Paul	3.20c
Shapes, New York	3.10c
Shapes, Cleveland	3.25c
Shapes, Philadelphia	3.25c
Shapes, Buffalo	3.20c
Shapes and plates, Cincinnati	3.20c to 3.50c
Plates, Chgo.	3.50c
Plates, St. Louis	3.55c
Plates, St. Paul	3.60c
Plates, New York	4.00c
Plates, Cleveland	3.65c
Plates, Philadelphia	4.00c
No. 10 blue anl. sheets, Chgo.	3.40c
No. 10 blue anl. sheets, Cleve.	3.50c
No. 10 blue anl. sheets, Buffalo	3.25c
No. 10 blue anl. sheets, St. Louis	3.45c
No. 10 blue anl. sheets, Cinci.	3.50c
No. 10 blue anl. sheets, St. Paul	3.50c
No. 28 black sheets, Chgo.	3.20c
No. 28 black sheets, Cleveland	2.95c
No. 28 black sheets, Cincinnati	3.95c
No. 28 black sheets, St. Louis	3.20c
No. 28 black sheets, St. Paul	3.35c
No. 28 galv. sheets, Chgo.	5.25c to 5.50c
No. 28 galv. sheets, Cleveland	5.25c
No. 28 galv. sheets, Cincinnati	5.65
No. 28 galv. sheets, St. Louis	5.25c to 5.50c

Freight Rates, Coke

Connellsville district, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50*
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.85
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

Arch bars and transoms, Chgo.	$19.50 to 20.00
Angle bars, iron, Chicago	18.50 to 19.00
Angle bars, steel, St. Louis	15.00 to 15.50
Arch bars and transoms, St. L.	20.00 to 20.50
Cut forge, Chicago	15.25 to 15.75
Knuckles, coup., Chgo.	15.50 to 16.00
Springs, St. Louis	16.00 to 16.50
Springs, Chgo.	16.50 to 17.00
Knuckles, coup., St. L.	16.00 to 16.50
Locomotive tires, Chicago	19.00 to 19.50
Locomotive tires, St. Louis	18.00 to 18.50
Railroad wrought, No. 1, Chgo.	16.75 to 17.25
Railroad wrought, No. 1, Cleve.	18.00 to 18.50
Railroad wrought, No. 1, St. L.	16.50 to 17.00
Railroad wrought, No. 1, Cinci.	12.75 to 13.25
Railroad wrought, No. 2, Chgo.	15.25 to 15.75
Railroad wrought, No. 2, St. L.	16.25 to 16.50
Shafting, St. Louis	17.50 to 18.00
Steel car axles, Birmingham	18.50 to 19.00
Steel car axles, St. Louis	26.00 to 26.50
Steel car axles, Chicago	26.00 to 26.50

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—	
New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Boiler plate, cut, No. 1 Chgo.	11.25 to 11.75
Boiler plate, cut, No. 1, St. L.	9.50 to 10.00
Boiler punchings, Chicago	14.00 to 14.50
Busheling, No. 1, Chicago	13.75 to 14.25
Busheling, No. 1, Cleveland	14.00 to 14.25
Busheling, No. 1, Cincinnati	10.50 to 11.00
Busheling, No. 1, St. Louis	13.25 to 13.75
Busheling, No. 2, Chicago	9.75 to 10.25
Bundled sheet, Cincinnati	8.50 to 9.00
Cast, No. 1, Cleveland	14.25 to 14.50
Cast, No. 1, Cincinnati	11.50 to 12.00
Cast, No. 1, St. Louis	14.00 to 14.50
Cast, No. 1, Chicago	13.50 to 14.00
Cast No. 1, Birmingham	11.00 to 11.50
Cast borings, Chicago	7.25 to 7.75
Cast borings, Cleveland	8.00 to 8.50
Cast borings, Cincinnati	7.50 to 8.00
Cast borings, St. Louis	7.00 to 7.50
Machine shop turnings, Chgo.	7.25 to 7.75
Machine shop turnings, Cleve.	8.00 to 8.50
Machine shop turnings, Cinci.	7.00 to 7.50
Machine shop turnings, St. L.	7.75 to 8.25
Malleable agricultural, Chgo.	12.00 to 12.50
Malleable agricultural, St. Louis	12.50 to 13.00
Malleable railroad, Chicago	13.50 to 14.00
Malleable, Cincinnati	8.50 to 9.00
Malleable railroad, St. Louis	13.50 to 14.00
Pipes and flues, Cleve. (nom.)	13.00 to 13.75
Pipes and flues, Chicago	12.25 to 12.75
Pipes and flues, St. Louis	12.50 to 13.00
Stove plate, Chicago	11.25 to 11.75
Stove plate, Cleveland	11.25 to 11.50
Stove plate, Buffalo	11.50 to 12.00
Stove plate, Cincinnati	8.00 to 8.50
Stove plate, St. Louis	10.00 to 10.50
Stove plate, Birmingham	10.00 to 10.50

(Gross tons.)

Busheling, No. 1, Buffalo	15.00 to 15.50
Busheling, No. 1, Pbgh	15.00 to 15.50
Busheling, No. 2, Buffalo	12.00 to 12.50
Bundled sheets, Pittsburgh	15.00
Bundled sheets, Cleveland	12.75 to 13.25
Bundled sheet, Buffalo	13.00 to 13.50
Car wheels (iron), Pittsburgh	15.50 to 16.00
Car wheels (steel), Pittsburgh	18.00 to 18.50
Car wheels, Chicago	13.50 to 13.75
Car wheels, eastern Pa.	17.00 to 17.50
Car wheels, Buffalo	15.25 to 15.75
Car wheels, N. Y.	15.50 to 16.00
Car wheels, St. Louis	13.50 to 14.00
Car wheels, Birmingham	12.50 to 13.00
Cast borings, New York	9.25 to 9.50
Cast borings, eastern Pa.	10.50 to 11.00
Cast borings, Buffalo	9.25 to 9.75
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